Chapter 10: Recycled Water System Master Plan Update

Chapter Contents:

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- Projected Recycled Water Demands
- Recycled Water Operational and Design Criteria
- Development of the Recycled Water Model
- Analysis of the Recycled Water Distribution System
- Recommended Capital Improvement Program

Chapter Highlights:

The purpose of this chapter is to present the Recycled Water System Master Plan Update, including:

- A description of the proposed recycled water system,
- Projected recycled water demands,
- Adopted performance and design criteria,
- Methodology used to develop the hydraulic model,
- Modeling results, and
- The recommended CIP.

As directed by District staff, this Recycled Water Master Plan only evaluates the District's portion of the DERWA system at buildout.

Based on the scenarios evaluated, major infrastructure including several new pipelines within Pressure Zone R1 is recommended.

Costs are presented in October 2005 dollars at an ENR CCI of 8409 (San Francisco). Costs include the following contingencies and allowances:

- Construction Cost Contingency = 20%
- Cost Allowances
  - ❖Engineering = 10%
  - ❖Construction Management = 10%
  - ❖Program Implementation = 10%

As with the potable water CIP, the recycled water CIP is consistent with the District's infrastructure policy.

Projected Recycled Water Demands:

Sub Area	Projected Annual Demand at Buildout, afa	Projected Average Day Demand at Buildout, mgd
Camp Parks	465	0.4
Central Dublin	309	0.3
Dougherty Valley	883	0.8
Eastern Dublin	2,042	1.8
Western Dublin	0	0.0
Totals	3,700 afa	3.3 mgd

Summary of Recycled Water System Recommendations & CIP Costs:

Recommended Major Infrastructure Improvements	DERWA System at Buildout
New Pipelines in Pressure Zone R1	$0.82 M
Total	$0.82 M

WEST YOST & ASSOCIATES
Consulting Engineers

CHAPTER 10. RECYCLED WATER SYSTEM

The purpose of this Chapter is to present the Recycled Water System Master Plan Update, including a description of the proposed recycled water system, projected recycled water demands, adopted performance and design criteria, methodology used to develop the hydraulic model, modeling results, and the recommended CIP.

PROPOSED RECYCLED WATER SYSTEM

Recycled water system information was obtained through review of previous reports, maps, plans, and operating records. Proposed facilities were inventoried and District staff were consulted on those facilities that have already been constructed and those planned as part of the ultimate DERWA recycled water system.

The following sections describe various components of the District's portion of the proposed DERWA recycled water distribution system, including the following:

- Recycled Water Service Area
- Recycled Water Supply
- Proposed Recycled Water Pressure Zones
- Proposed Recycled Water Storage Tanks
- Proposed Recycled Water Pump Stations
- Proposed Recycled Water Pipelines

Recycled Water Service Area

Starting in 1995, the District began experiencing significant growth in the eastern portion of the City of Dublin and Dougherty Valley, with development plans proposed for the western portion of the City of Dublin (i.e., Schaefer Ranch) and the existing military base (i.e., Camp Parks). Consequently, the District began working with EBMUD on the San Ramon Valley Recycled Water Project (SRVRWP), a joint project operated through DERWA to provide recycled water service to landscape irrigation customers in the San Ramon Valley and adjacent areas.

The SRVRWP was specifically developed to provide recycled water that met Title 22 requirements for unrestrictive use to landscape irrigation customers of EBMUD and the District, including the City of San Ramon, City of Dublin, Dougherty Valley, Town of Danville, and Town of Blackhawk areas of Alameda and Contra Costa Counties. The portions of the SRVRWP that are under District control coincide with its potable water service area and include the City of Dublin and Dougherty Valley. A description of the District's SOI, water service area, sub areas, and corresponding sub area prioritization follows.

Sphere of Influence and Water Service area

The District's SOI is located approximately 10-miles west of Livermore, along Interstate 580, and encompasses approximately 27 square miles (17,480 acres), while the service area is contained within the SOI and encompasses approximately 24 square miles (15,070 acres). Figure 10-1 illustrates the location of the District's SOI, service area, and recycled water service area.

Recycled Water Service Sub Areas & Corresponding Prioritization

The District has also identified six recycled water service sub areas that include Camp Parks – City Development, Camp Parks Proper, Central Dublin, Dougherty Valley, Eastern Dublin, and Western Dublin. However, recycled water supplies projected for the DERWA system are limited and each of these sub areas was prioritized as part of the 2000 Water Master Plan. The priority for each sub area was designated as follows, with Priority 1 being the most important to serve and Priority 5 being the least import to serve:

- Priority 1: Selected portions of Eastern Dublin; selected schools and parks in Central Dublin located near major recycled water transmission mains
- Priority 2: Dougherty Valley
- Priority 3: Eastern Dublin
- Priority 4: Camp Parks
- Priority 5: Central Dublin and Western Dublin (Schaefer Ranch)

Prioritization of these areas was based on discussion with District staff and included evaluating the feasibility, capital costs, and operating costs of providing recycled water service to certain sub areas.

The recycled water system supply is limited to 16.5 mgd at buildout, and only 9.6 mgd of this total supply is available to the District. As will be shown in the Projected Recycled Water Demands section of this chapter, the total demand for Priority 1 through Priority 4 areas is approximately 9.6 mgd, leaving no recycled water supply available for Priority 5 areas (Central and Western Dublin).

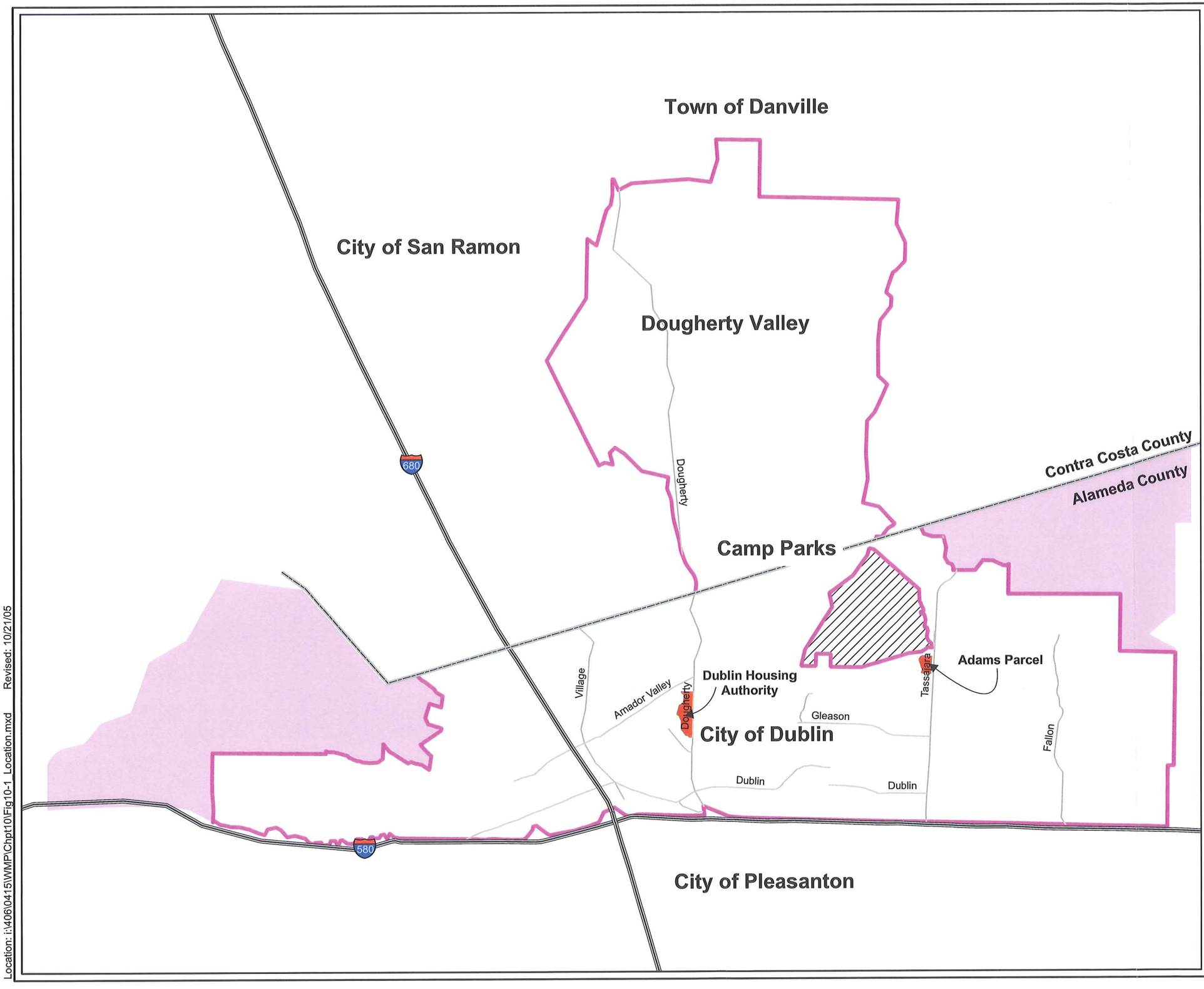
Consequently, recycled water infrastructure was only planned for the Camp Parks – City development, Camp Parks – Proper, Dougherty Valley, and Eastern Dublin sub areas, and a few high priority areas (e.g., schools) located near major transmission mains in Central Dublin. WYA did not consider recycled water use in other portions of Central Dublin or Western Dublin as part of this Recycled Water Master Plan Update. Figure 10-2 illustrates the location of all six sub areas and their corresponding priority.

In addition to only planning recycled water infrastructure for areas east of I-680, WYA also limited the analysis to the District's existing treatment plant and distribution system in conjunction with planned DERWA facilities. The District's existing system was not evaluated by itself because most of the DERWA facilities have already been constructed and the entire system is expected to be completed by the Fall of 2005. Figure 10-3 illustrates the District's existing

FIGURE 10-1

Dublin San Ramon
Services District
Water Master Plan Update

RECYCLED WATER SERVICE AREA



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0 0.2 0.4 0.8
Scale in Miles

LEGEND:

- Recycled Water Service Area
- Area Not Within District Service Area
- Sphere of Influence
- Area Not Served by the District
- Major Streets
- County Line
- Interstate Highway

DSRSD

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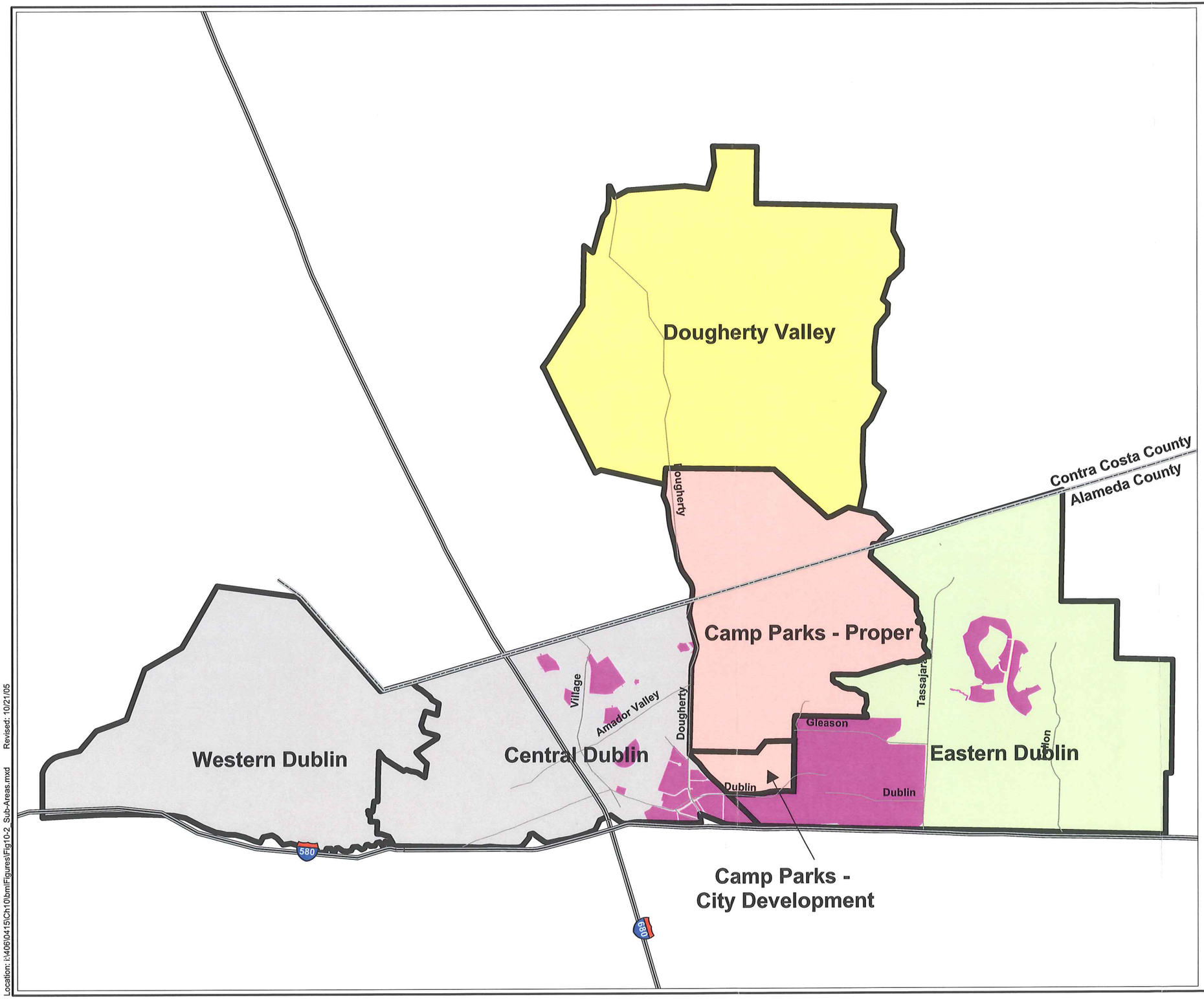
FIGURE 10-2

Dublin San Ramon Services District Water Master Plan Update

RECYCLED WATER SUB-AREAS



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0 0.2 0.4 0.8

SCALE IN MILES

LEGEND:

- County Line
- Interstate Highway
- Major Roads
- Sub-Area Boundary
- Priority 1 Areas
- Priority 2 Areas
- Priority 3 Areas
- Priority 4 Areas
- Priority 5 Areas

DUBLIN SAN RAMON SERVICES DISTRICT

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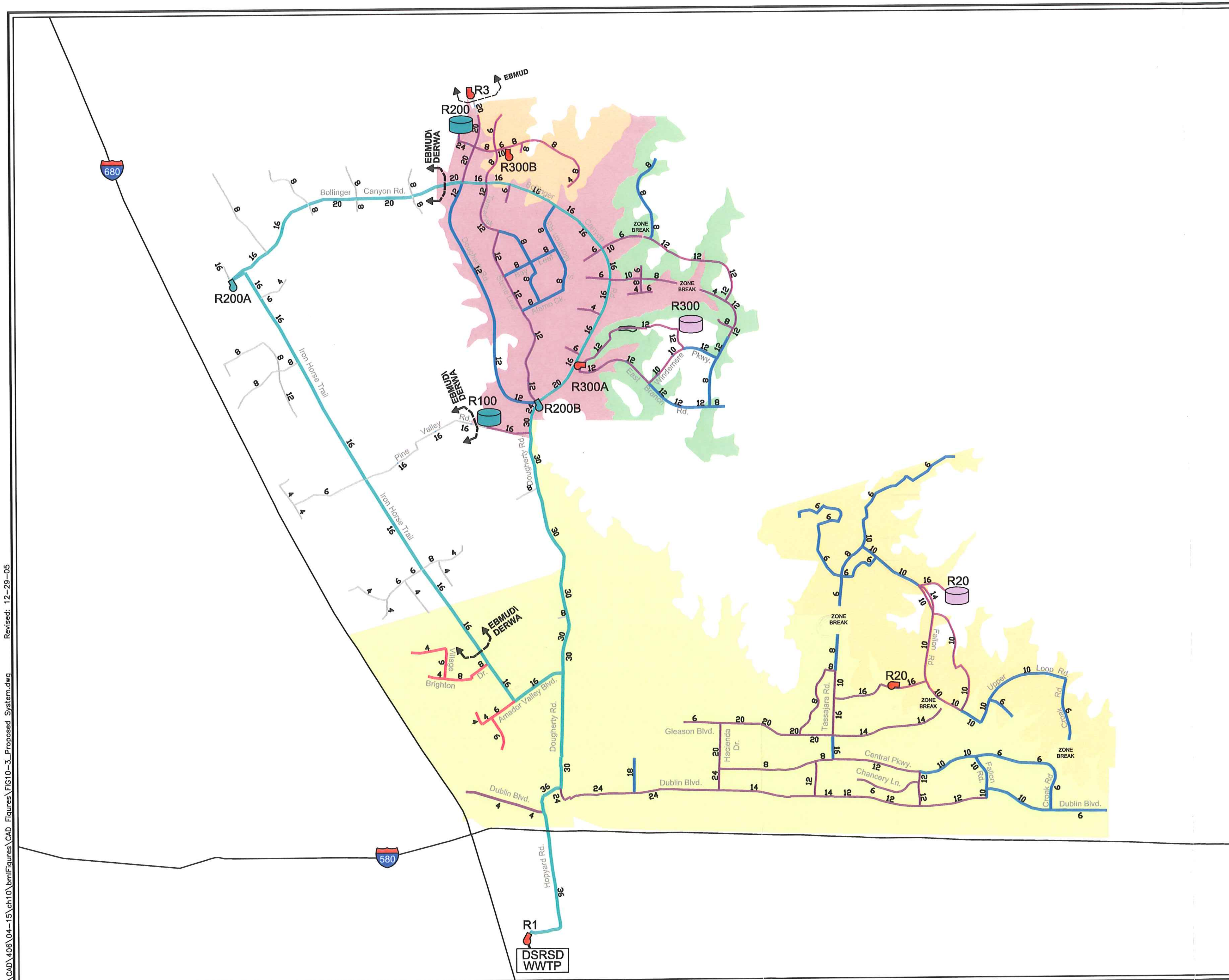

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FIGURE 10-3

Dublin San Ramon Services District Water Master Plan Update

PROPOSED RECYCLED WATER SYSTEM

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SCALE IN MILES

NOTES:

24 Diameter, inches

LEGEND:

- Existing District Pipeline
- Pipeline in the District's CIP
- Pipeline To Be Installed by Developer
- DERWA Pipeline Not in CIP
- EBMUD Pipeline Not in CIP
- District Storage Tank
- DERWA Storage Tank
- District Pump Station
- DERWA Pump Station
- Pressure Zone R1
- Pressure Zone R20
- Pressure Zone R200
- Pressure Zone R300A
- Pressure Zone R300B

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recycled water system and planned DERWA facilities; this Recycled Water Master Plan Update herein refers to all facilities as the recycled water system.

Recycled Water Supply

The District meets its existing recycled water demands using recycled water supplied from its Microfiltration Ultraviolet (MFUV) facilities, which provide treatment of effluent from the District's wastewater treatment plant (WWTP). The District is upgrading its recycled water facilities at the WWTP by constructing Sand Filtration Ultraviolet (SFUV) facilities to serve the SRVRWP, and the first phases of these construction upgrades should be completed in Fall 2005. Subsequent sections describe the District's existing MFUV facilities, the improvements at the WWTP and SFUV facilities, and available backup recycled water supply.

Existing Microfiltration Ultraviolet Facilities

The Recycled Water Treatment Facilities (RWTF) consist of the existing MFUV facilities and the Sand Filtration Treatment Facilities (SFTF) currently being constructed.

The MFUV facilities were designed to provide advanced wastewater treatment to allow for non-potable reuse and the potential for future replenishment and improvement of local groundwater quality. Construction of the project was completed in 1999. The MFUV project is currently producing recycled water meeting California Title 22 requirements for unrestricted reuse and has received approval for groundwater recharge from the DHS. In addition to this DHS approval, the District has received approval from the Regional Water Quality Control Board (RWQCB). Legal action by outside parties resulted in a requirement that the RWQCB reconsider permit approval. However, the District has determined that it will not ask for RWQCB reconsideration or proceed with the injection of this highly treated recycled water into the local groundwater basin at this time. The current capacity of the MFUV is 3.0 mgd. In 2004, the maximum day delivery of recycled water for landscape irrigation purposes was 1.5 mgd. Once the SFTF facilities are completed in Fall 2005, the MFUV facilities will serve as backup facilities.

Improvements Planned for the District's WWTP

The recycled water system includes improvements to the District's pump stations at the WWTP and SFTF. The improved facilities will increase available discharge pressure and capacity to approximately 176 psi and 11,500 gpm (16.6 mgd), respectively. The first phase of improvements is currently under construction and is expected to be fully operational by the irrigation season of 2006. Although the total supply is projected to be around 16.5 mgd, only approximately 9.6 mgd is available for use by the District; the remaining recycled water supply (6.9 mgd) will be allocated to EBMUD.

Backup Recycled Water Supply and Recycled Water Inter-Connection Facility

Water from the District's potable system is the only formal backup supply for the recycled water distribution system. However, several other potential supplies could be used by the District to partially backup its recycled water supplies, and include seasonal storage using aquifer storage and recovery wells located in the fringe basin, supplemental groundwater supply from District-owned wells, and use of potable water from Pressure Zone 300 in Dougherty Valley.

Currently, the District supplements its recycled water demand for Eastern Dublin and Dougherty Valley with potable water. Eastern Dublin recycled water demands are supplemented with potable water through a unique inter-connection facility that allows for various flow routings between the potable system, recycled water system, and the Camp Park wells. This facility is located at the northwest corner of the intersection of Dublin Boulevard and Tassajara Creek, and includes a complex piping arrangement utilizing removable pipe sections (swivel elbows) and reduced pressure backflow prevention assemblies to prevent cross-connections with the potable water system. The District plans to use this facility until all facilities are completed; this facility will be abandoned afterwards because it cannot be used as a backup due to cross-connection control requirements. After the abandonment, potable Pump Station 30A will be used to backup recycled water supply in Reservoir R20. Dougherty Valley recycled water demands are supplemented with potable water from potable Pump Station 300B. Reservoir R300 is currently filled with potable water.

Proposed Recycled Water Pressure Zones

The recycled water distribution system will consist of five pressure zones: Pressure Zone R1, R20, R200, R300A, and R300B. Pressure Zones R1 and R20 serve the Camp Parks, Central Dublin, Eastern Dublin, and Western Dublin sub areas, while Pressure Zones R200, R300A, and R300B will serve the Dougherty Valley sub area. Pressure Zones R1 and R300 also serve the south and central portions of the City of San Ramon, located within EBMUD's service area. Figure 10-3 illustrates the location of the District's five recycled water pressure zones at buildout. A more detailed description of each pressure zone follows.

Pressure Zone R1

Pressure Zone R1 will be the largest of the recycled water system pressure zones and will stretch from the Western Dublin sub area to portions of the East Dublin sub area. Pump Station R1 at the WWTP feeds Pressure Zone R1, which is planned to serve areas in Camp Parks, Central Dublin, Eastern Dublin, and Western Dublin located at elevations between 330 and 480 feet. The District currently uses Pressure Zone R1 to serve existing untreated demands in Central and East Dublin with recycled water supplied from its MFUV Facility. Pressure Zone R1 also serves the southern portion of the City of San Ramon, located within EBMUD's service area.

Pressure Zone R20

Existing Pump Station R20 feeds water from Pressure Zone R1 into Pressure Zone R20, which is planned to serve areas in Eastern Dublin located at elevations between 480 and 640 feet. Although Pressure Zone R20 was originally designed to only serve customers located above 480 feet, a zone break located along Tassajara Road (see Figure 10-3) requires Pressure Zone R20 to serve a few customers located below 480 feet, which will likely result in higher pressures in that area.

The District currently uses Pressure Zone R20 to serve existing untreated demands in Eastern Dublin (e.g., the Dublin Ranch golf course) with recycled water produced at its MFUV Facility.

Pressure Zone R200

Pump Station R200A and R200B will feed water from Pressure Zone R1 into Pressure Zone R200, which is planned to serve areas in Dougherty Valley located at elevations between 480 and 580 feet. The District is currently serving existing untreated demands in Pressure Zone R200 with potable water from Tank R300. Pressure Zone R200 also serves the central portion of the City of San Ramon, located in EBMUD's service area.

Pressure Zone R300A

Pump Station R300 feeds water from Pressure Zone R200 into Pressure Zone R300A, which is planned to serve areas within Dougherty Valley, located between 580 and 670 feet in elevation. Although Pressure Zone R300A was originally designed to only serve customers above 580 and below 670 feet in elevation, two existing zone breaks (see Figure 10-3) require Pressure Zone R300A to serve a few customers located below 580 and above 670 feet in elevation, which will likely cause high and low pressures in these areas. The District is currently serving existing recycled water demands in Pressure Zone R300A with potable water from Tank 300A.

Pressure Zone R300B

A booster pump located in Gale Ranch Phase 2 (northeast of the intersection of Bollinger Canyon and Dougherty Road), in the Shapell Development area of Dougherty Valley, will feed water from Pressure Zone R200 into Pressure Zone R300B, which will serve areas located in the northeast portion of Dougherty Valley. Original planning documents did not indicate the planned service elevations for Pressure Zone R300B; however, developer maps provided by the District indicate services will be located between 610 and 714 feet. The District is not currently using Pressure Zone R300B.

Table 10-1 summarizes the proposed pressure zones for the recycled water system. As shown in Table 10-1, Pressure Zones R20, R300A, and R300B have customers located in areas outside of the planned service elevation range for the pressure zone. This observation indicates that these customers may experience high/low pressures. This potential issue was investigated further in subsequent sections of this Recycled Water Master Plan.

Table 10-1. Summary of Pressure Zones for the Proposed DERWA System

Pressure Zone	Planned Service Elevations, ft msl	Range of Actual Elevations Served, ft msl	Sub areas Served
R1[(a)]	320 to 480	330 to 480	Camp Parks, Central Dublin, and portions of Eastern Dublin
R20[(a)]	480 to 640	440 to 630	Eastern Dublin
R200[(a)]	480 to 580	480 to 580	Majority of Dougherty Valley
R300A[(a)]	580 to 670	500 to 730	Portions of on the eastern side of Dougherty Valley
R300B[(b)]	Elevations outside the planned range for R300A	610 to 714	Small northern portion of Dougherty Valley

(a) Obtained from Table 4 of the December 2003 Final Design Hydraulic Modeling TM.

(b) No original planning numbers were provided for Pressure Zone R300B; however, this pressure zone was created to serve elevations located outside the planned service elevation range for Pressure Zone R300A.

Proposed Recycled Water Storage Tanks

Four recycled water storage tanks were constructed to serve the recycled water system. These four tanks are R20, R100, R200, and R300. The locations of the four recycled water storage tanks are illustrated on Figure 10-3, while Figure 10-4 presents an HGL of the system, including the storage tanks. A more detailed description of each tank follows.

Tank R20

Tank R20 is a 1.5-MG, below ground reinforced concrete tank located in the hills above East Dublin, just east of Fallon Road. This tank was constructed in 2003 with a floor elevation of approximately 760 feet and serves Pressure Zone R20. Pump Station R20 fills Tank R20 through a 16-inch diameter and 10-inch diameter transmission main, and its water level fluctuates based on the demands of Pressure Zone R20. Results of recent hydraulic modeling, conducted by WYA separately from this Water Master Plan Update, recommended the District install a new 14-inch diameter main that runs parallel to the existing 10-inch diameter main to fix low pressures observed at the Golf Course located in Eastern Dublin. The District constructed this pipeline in August 2004, and it reduced pipeline losses incurred by flows from Tank R20.

Tank R100

Tank R100 is a 4.36-MG, below ground reinforced concrete tank located in the southern portion of the Dougherty Valley sub area, just west of Dougherty Road. This tank was constructed and is expected to be operational by Fall of 2005. Tank R100 was constructed with a floor elevation of 598 feet and will be filled by Pump Station R1 (located at the WWTP).

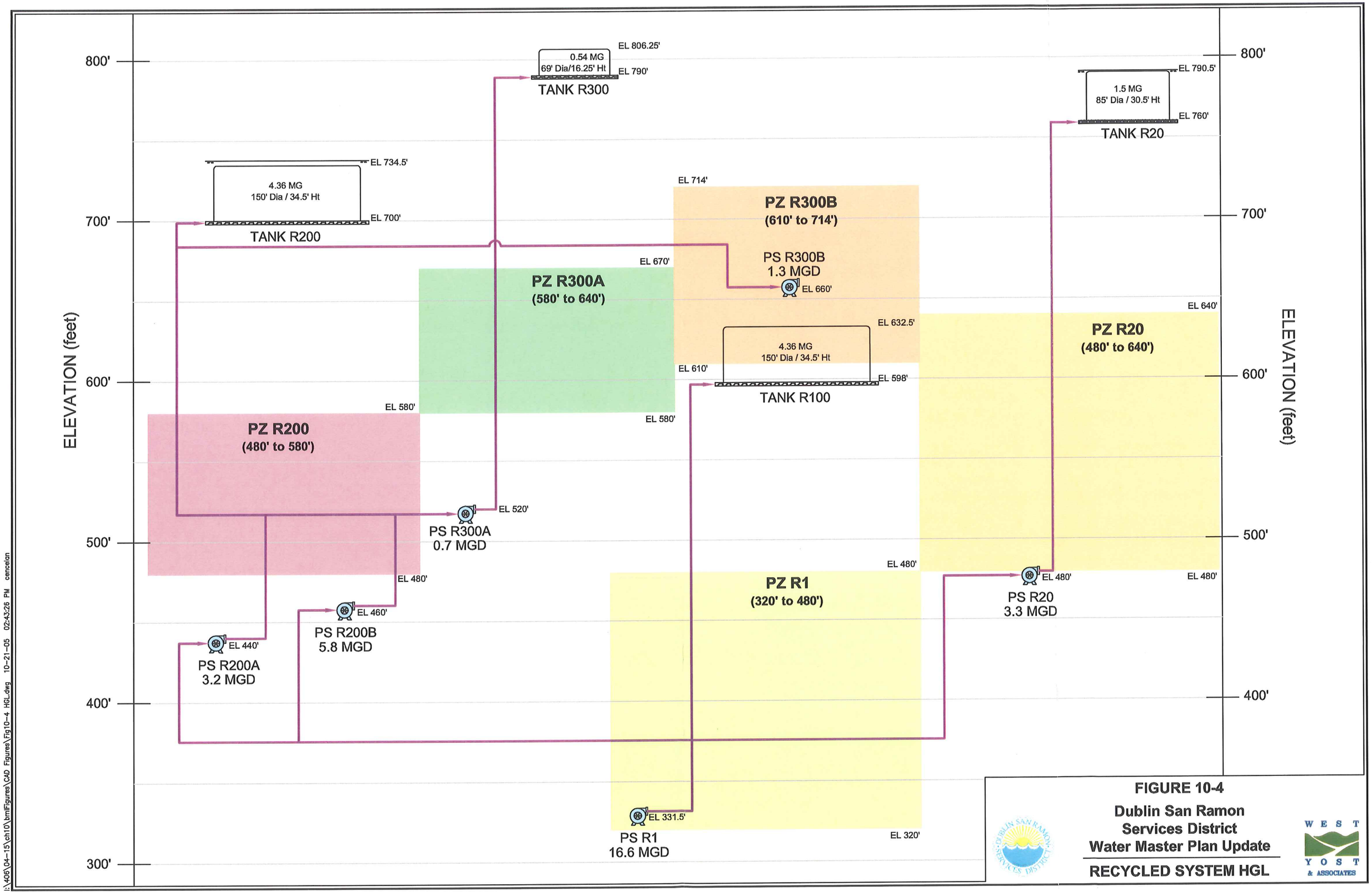


FIGURE 10-4

Dublin San Ramon Services District Water Master Plan Update

RECYCLED SYSTEM HGL

Tank R100 will be used to serve recycled water demands within both the District's and EBMUD's service area. However, both service areas use Pressure Zone R1 and therefore, the water levels of Tank R100 will only fluctuate based on the demands within Pressure Zone R1, all other pressure zones pumping from R1, and the time of operation of Pump Station R1, R20, R200A, and R200B.

Tank R200

Tank R200 is a 4.36-MG, below ground reinforced concrete tank located in the north portion of the Dougherty Valley sub area, between Bollinger Canyon and Crow Canyon Road. This tank was constructed and expected to be operational by Fall of 2005. Tank R200 has a floor elevation of 700 feet and will be filled by Pump Station R200B and to a lesser extent, by Pump Station 200A.

Tank R200 will be used to serve untreated demands within both the District's and EBMUD's service area. Water levels of Tank R200 will fluctuate based on the demands within Pressure Zone R200 and R300B, and the time of operation of Pump Stations R200A, R200B, R300A, R300B, and 3 (EBMUD Pump Station).

Tank R300

Tank R300 is a 0.54-MG, aboveground steel tank located east of Bollinger Canyon Road in Dougherty Valley. This tank was constructed in 2003 with a floor elevation of approximately 790 feet and serves Pressure Zone R300A. Tank R300 is filled directly by Pump Station 300A or by gravity from Tank 300 (see Figure 2-4), but will eventually be filled by Pump Station R300A once improvements to the wastewater treatment plant are completed. Water levels in Tank R300 will fluctuate based on the demands within Pressure Zone R300A and the time of operation of Pump Station R300A.

Table 10-2 summarizes the District's proposed recycled water storage tanks. As shown in Table 10-2, the District's current proposed total recycled water storage is 10.76 MG.

Table 10-2. Summary of Recycled Water Tanks[(a)]

Pressure Zone	Tank	Diameter, ft	Floor Elevation, ft msl	Overflow Elevation, ft msl	Capacity, MG
R1	R100	150	598	632.5	4.36
R20	R20	85	760	790.5	1.5
R200 and R300B	R200	150	700	734.5	4.36
R300A	R300	69	790	806.25	0.54
Total					10.76

(a) Based on drawings and other pertinent data provided by the District.

Proposed Recycled Water Pump Stations

Six recycled water pump stations are proposed to serve the recycled water system. These six pump stations are Pump Stations R1, R20, R200A, R200B, R300A, and R300B. The locations of the six recycled water pump stations are illustrated on Figure 10-3, while Figure 10-4 presents a HGL of the system, including the pump stations. A more detailed description of the proposed pump stations follow.

Pump Station R1

The District currently uses pumps originally constructed as part of its MFUV Facility to feed existing untreated demands in Pressure Zone R1. The MFUV Facility pump station has a current capacity of approximately 1,740 gpm (2.5 mgd) and is too small to meet the full, projected recycled water demands that will be required in the future.

Consequently, Pump Station R1 is being constructed at the District's WWTP and will be operational in the Fall of 2005. Pump Station R1 will replace the MFUV Facility, and provide a discharge pressure and capacity to approximately 176 psi and 16.6 mgd (11,500 gpm), respectively. Pump Station R1 will be used to fill Tank R100, and feed Pressure Zone R1, which will provide flow to Pump Stations R20, R200A, and R200B.

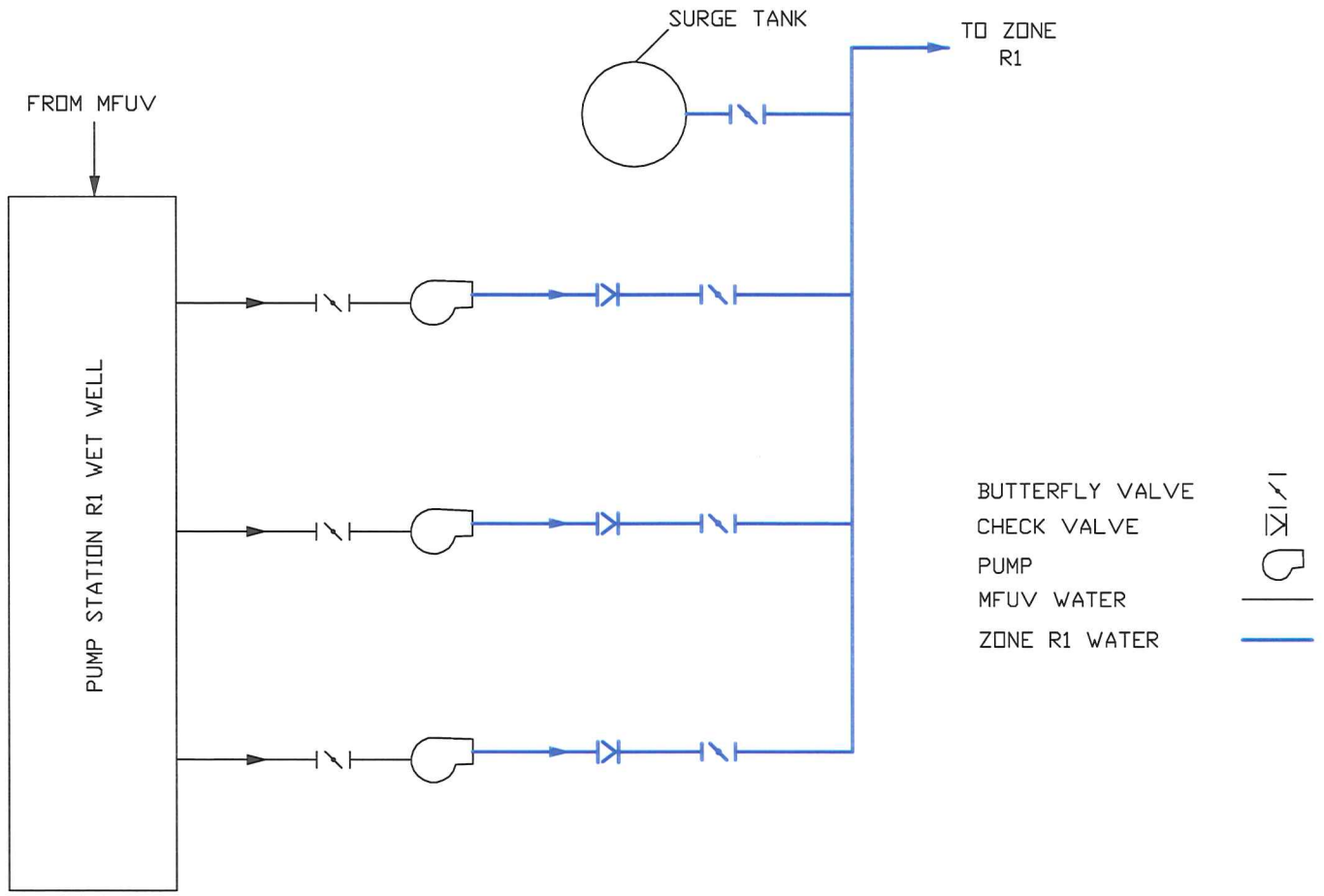
Additionally, Pump Station R1 draws water from a wet well constructed at the WWTP, and is the only other system control for water levels in the wet well besides the Livermore Amador Valley Water Management Agency (LAVWMA) pipeline. Consequently, for optimal efficiency at system buildout, Pump Station R1 must be operated at a constant flow rate 24-hours a day; the other pump stations in the system must also be operated at a constant rate for 24-hours to facilitate operation of Pump Station R1. Figure 10-5 illustrates a schematic of Pump Station R1.

Pump Station R20

Pump Station R20 is located in a park along Antoine Way in the middle of the Eastern Dublin sub area. Pump Station R20 was constructed in 2003 and contains three, 125-Hp turbine pumps, each with a pumping capacity of 1,150 gpm (1.66 mgd) and a discharge pressure of approximately 138 psi. With two pumps operating at a time, the pump station has a capacity of approximately 2,300 gpm (3.3 mgd). Pump Station R20 also has a PRV located between the suction and discharge lines, allowing water to flow from Pressure Zone R20 to R1; this valve is normally closed. Pump Station R20 draws water from Pressure Zone R1 and as discussed previously, is operated at a constant flow rate 24-hours a day to help facilitate operation of Pump Station R1. Figure 10-6 illustrates a schematic of Pump Station R20.

Pump Station R200A

Pump Station R200A will be located near the intersection of the Union Pacific Railroad (Iron Horse Trail) right-of-way and Bollinger Canyon Road, east of the Dougherty Valley sub area. This pump station will be constructed and paid for by EBMUD as part of Phase 2 of the DERWA system and will not become available within the next two years. Pump Station R200A will have approximately three pumps with a combined capacity of 3.2 mgd (2,200 gpm), and will serve the demands of Pressure Zone R200, while helping to fill Tank R200. Pump Station R200A also has



DUBLIN SAN RAMON SERVICES DISTRICT
PUMP STATION R1 - WASTE WATER TREATMENT PLAN
(NOT TO SCALE)

LEGEND

SEE ABOVE

FIGURE 10-5

DSRSD
Water Master Plan Update
PS R1 SCHEMATIC

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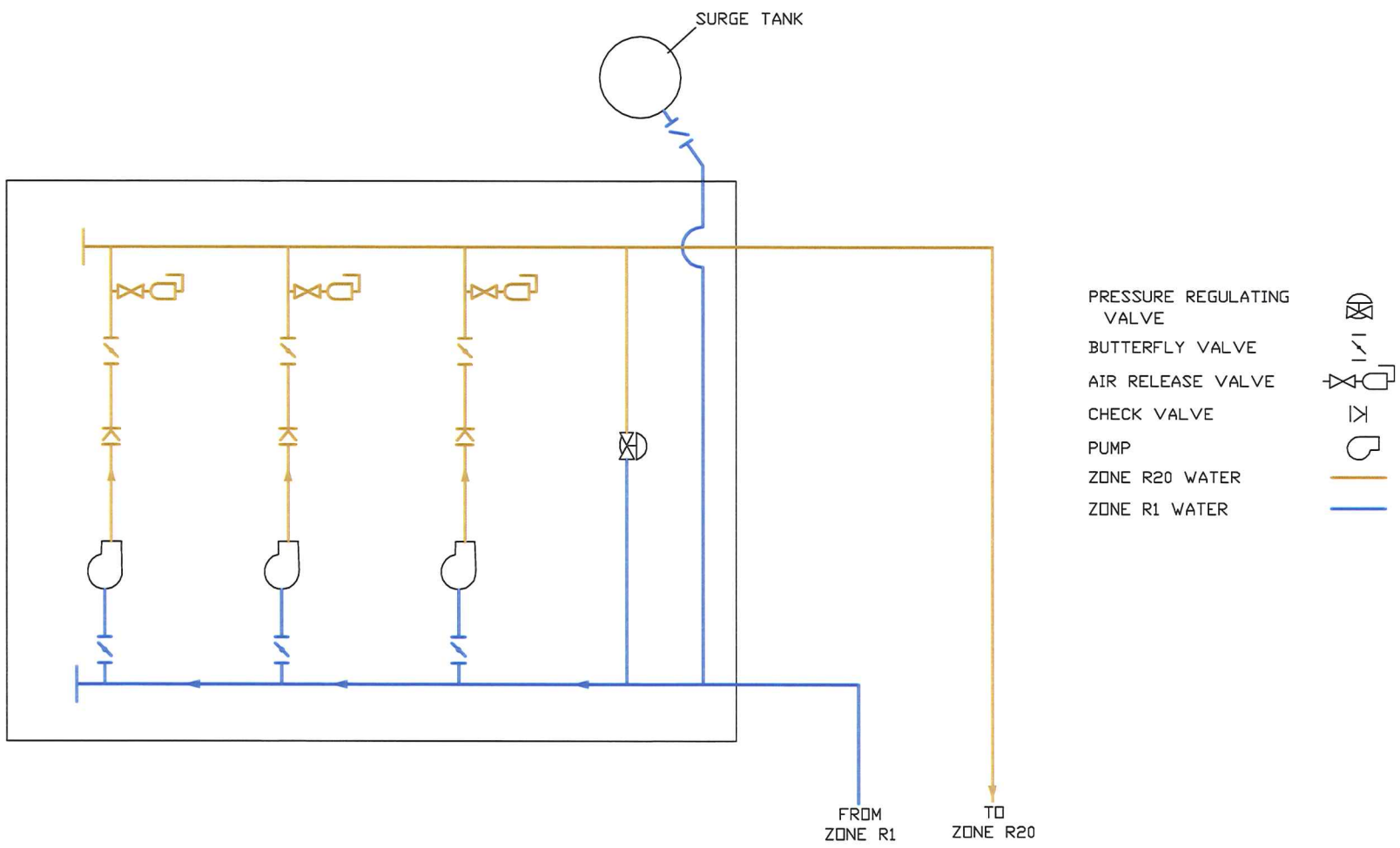

DUBLIN SAN RAMON SERVICES DISTRICT
PUMP STATION R20 - ANTONE WAY
(NOT TO SCALE)

LEGEND

SEE ABOVE

FIGURE 10-6

DSRSD
Water Master Plan Update
PS R20 SCHEMATIC

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a PRV located between the suction and discharge lines, allowing water to flow from Pressure Zone R200 to R1; this valve is normally closed. Pump Station R200A will also be operated at a constant flow rate 24-hours a day to facilitate operation of Pump Station R1. Figure 10-7 illustrates the proposed schematic of Pump Station R200A.

Pump Station R200B

Pump Station R200B is located in the southern portion of the Dougherty Valley sub area, near the intersection of Dougherty and Old Ranch Road. This pump station was constructed as part of Phase 1 of the DERWA system and is expected to be operational by Fall of 2005. Pump Station R200B has three pumps with a combined ultimate capacity of approximately 5.8 mgd (4,000 gpm). Pump Station R200B will also have two PRVs located between the suction and discharge lines, allowing water to flow from Pressure Zone R200 to R1; these valves are normally closed. Pump Station R200B will serve the demands of Pressure Zone R200 and help fill Tank R200. Pump Station R200B will also be operated at a constant flow rate 24-hours a day to facilitate operation of Pump Station R1. Figure 10-8 illustrates a schematic of Pump Station R200B.

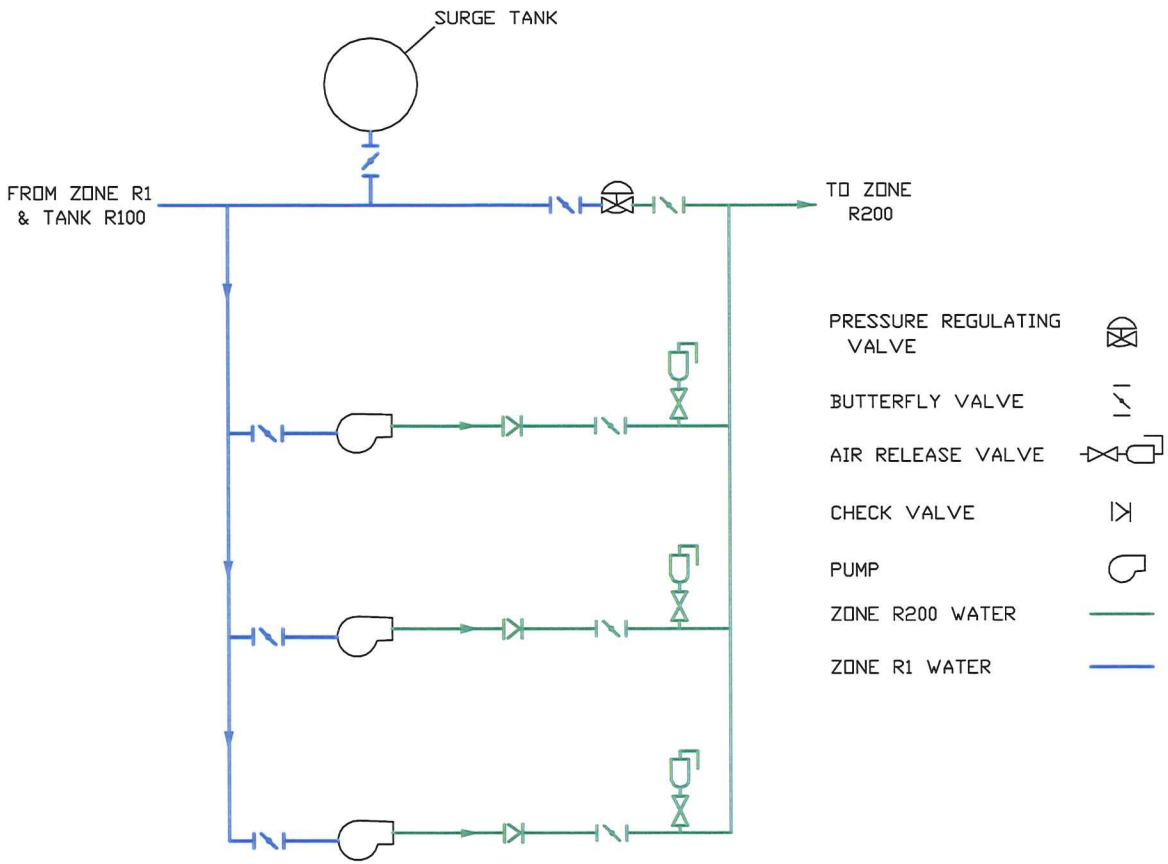
Pump Station R300A

Pump Station R300A will be located in the southern portion of the Dougherty Valley sub area, between Pump Station R200B and Tank R300. This pump station was constructed and is expected to be operational by Fall of 2005. Pump Station R300A has three pumps with a combined ultimate capacity of 1.44 mgd (1,000 gpm). Pump Station R300A also has two PRVs located between the suction and discharge lines, allowing water to flow from Pressure Zone R300A to R200; these valves are normally closed. Pump Station R300A will be used to fill Tank R300 and meet the demands within Pressure Zone R300A. Figure 10-9 illustrates a schematic of Pump Station R300A.

Pump Station R300B

Pump Station R300B is a booster pump located in Gale Ranch Phase 2 (northeast of the intersection of Bollinger Canyon and Dougherty Road, in the Shapell Development area of Dougherty Valley, and will feed water from Pressure Zone R200 into Pressure Zone R300B. Pump Station R300B has five pumps with a combined ultimate capacity of approximately 1.3 mgd (920 gpm); the five pumps include three pumps rated at 300 gpm and two jockey pumps rated at 10 gpm. Pump Station R300B will serve the demands in Pressure Zone R300B and will only operate during the 10-hour irrigation demand period, because Pressure Zone R300B has no tank. Daily operations will limit flow through the pump station to approximately 409 gpm (the demand for Pressure Zone R300B). Figure 10-10 illustrates a schematic of Pump Station R300B.

Table 10-3 summarizes the recycled water pump stations available to serve the recycled water system. As shown in Table 10-3, the total recycled water pumping capacity is 31.6 mgd.



DUBLIN SAN RAMON SERVICES DISTRICT
PUMP STATION R200A - IRON HORSE TRAIL
(NOT TO SCALE)

LEGEND

SEE ABOVE

FIGURE 10-7

DSRSD
Water Master Plan Update
PS R200A SCHEMATIC

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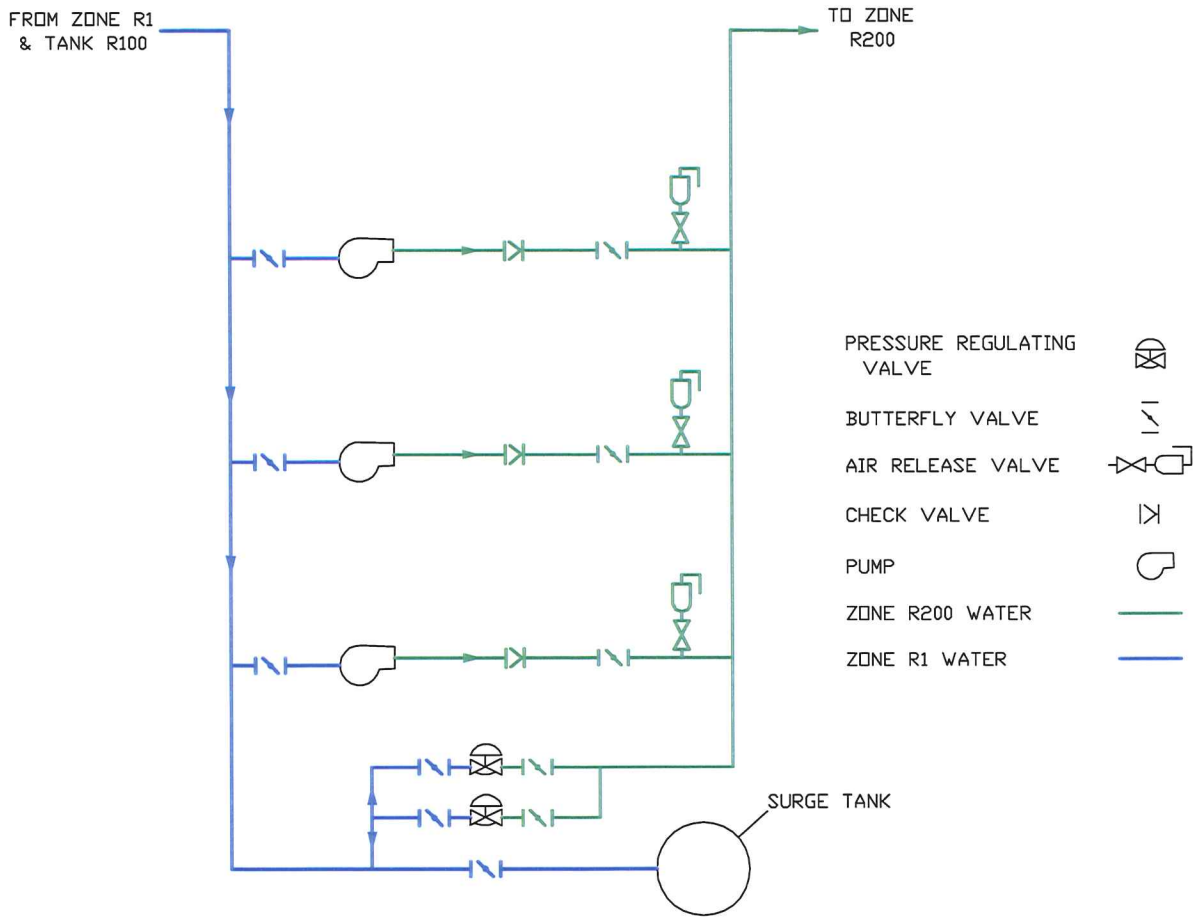

DUBLIN SAN RAMON SERVICES DISTRICT
PUMP STATION R200B - DOUGHERTY ROAD
(NOT TO SCALE)

LEGEND

SEE ABOVE

FIGURE 10-8

DSRSD
Water Master Plan Update
PS R200B SCHEMATIC

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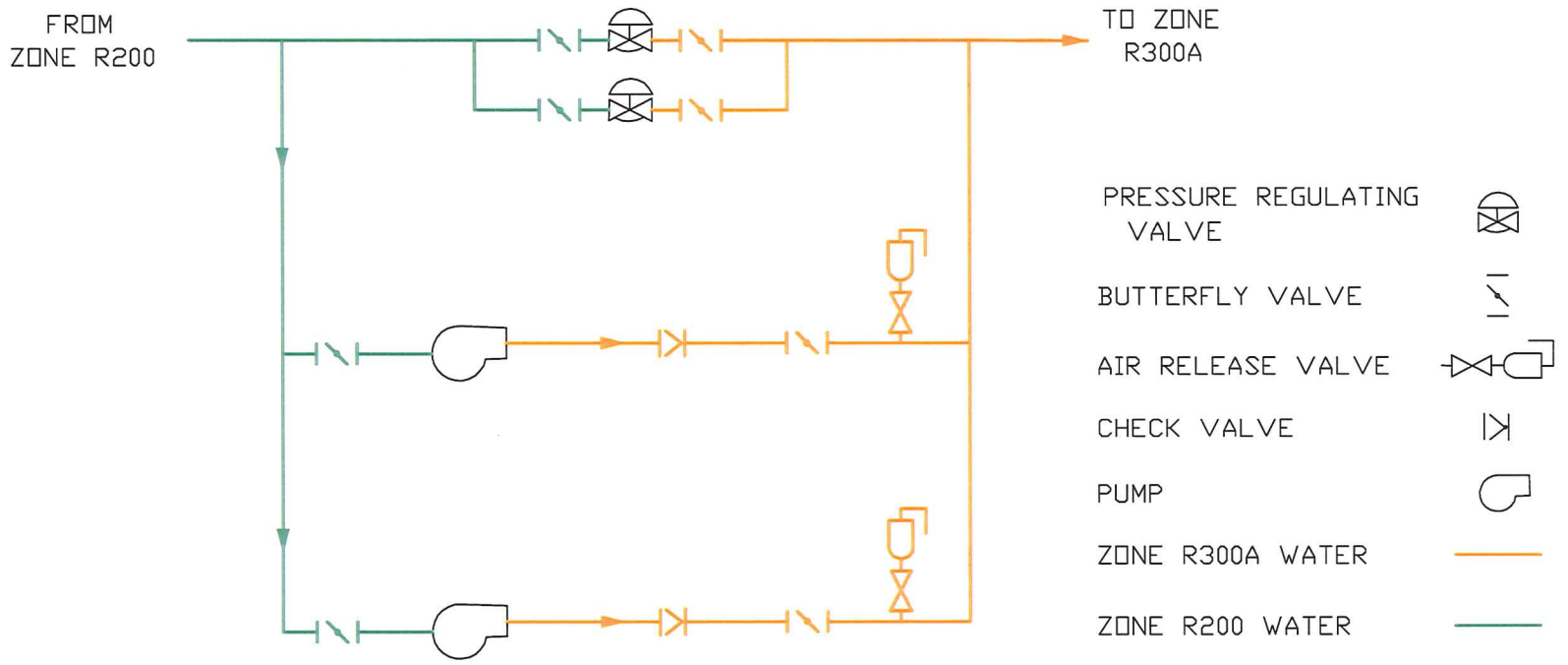

DUBLIN SAN RAMON SERVICES DISTRICT
PUMP STATION R300A - BOLLINGER CANYON
(NOT TO SCALE)

LEGEND

SEE ABOVE

FIGURE 10-9

DSRSD
Water Master Plan Update
PS R300A SCHEMATIC

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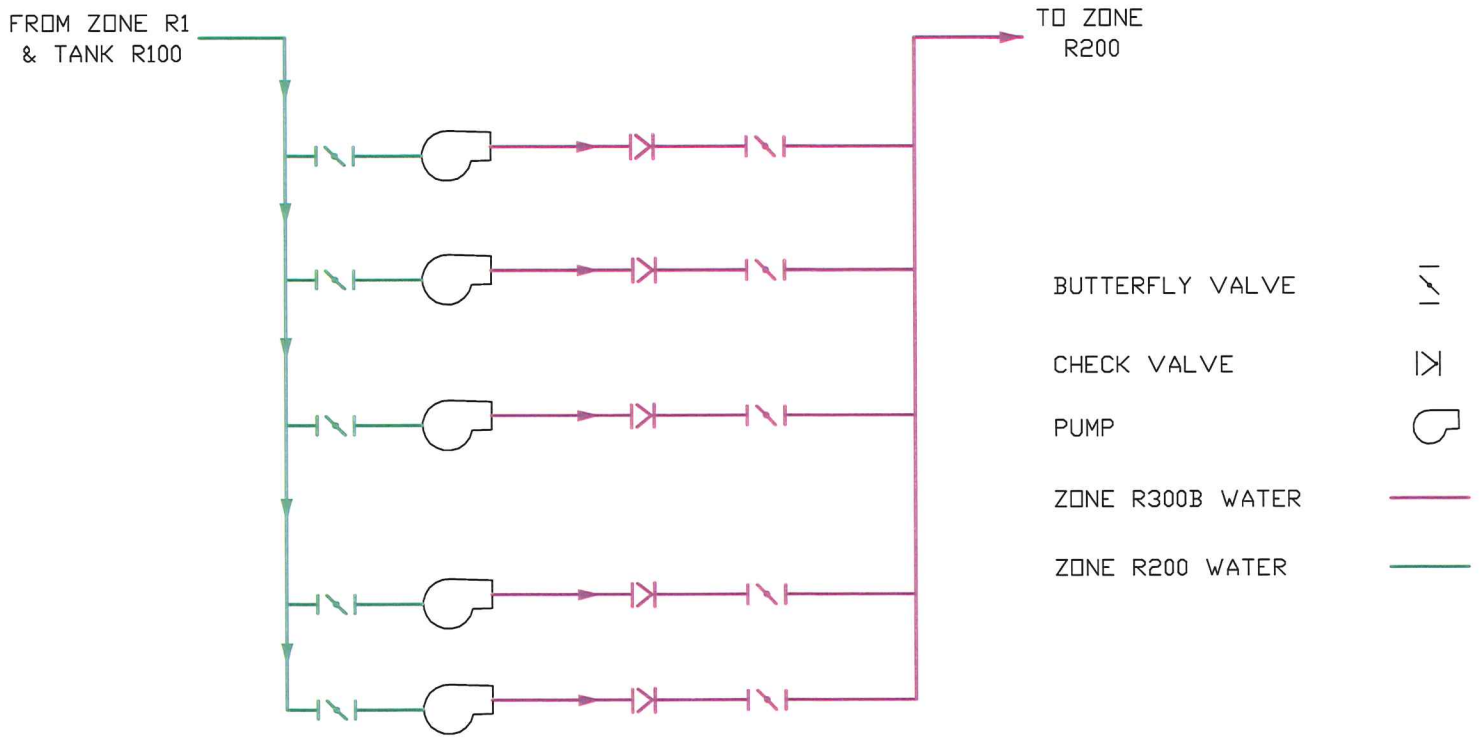

DUBLIN SAN RAMON SERVICES DISTRICT
PUMP STATION R300B - DOUGHERTY ROAD
(NOT TO SCALE)

LEGEND

SEE ABOVE

FIGURE 10-10

DSRSD
Water Master Plan Update
PS R300B SCHEMATIC

WEST YOST & ASSOCIATES

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Table 10-3. Summary of Proposed Recycled Water Pump Stations

Pressure Zone	Pump Station	Year Completed	Ultimate Proposed Capacity, MG
R1	R1	2005	16.6
R20	R20	2003	3.3
R200	R200A	Available in the next 2 years	3.2
	R200B	2005	5.8
R300A	R300A	2005	1.44
R300B	R300B	2005	1.3
Total			31.6

Proposed Recycled Water Pipelines

The ultimate recycled water system will consist of over 60 miles of pipelines (approximately 50 miles within the DSRSD service area and 13 miles with the EBMUD service area), having diameters ranging from 4 to 36 inches in diameter, and material types consisting of Ductile Iron, Steel, and PVC.

PROJECTED RECYCLED WATER DEMANDS

The purpose of this section is to present the projected recycled water demands for the District. Accurate and detailed recycled water demand estimates are required to develop the District's recycled water hydraulic model. These demand estimates, and particularly the timing of these demands, are important to assist the District in having the required recycled water system infrastructure constructed and available for use when needed.

The following describe the data and methodology utilized to determine the District's recycled water system demands as follows:

- Projected Land Use for the District's Recycled Water Service Area
- Historical Recycled Water Production and Consumption
- Adopted Peaking Factors
- Verification of the Irrigation Application Rate
- Projected Recycled Water Demands
- Peak Conditions & Timing

Projected Land Use for the Recycled Water Service Area

Figure 10-11 presents the District's projected land use; this land use is the same land use previously presented in Chapter 3. Although the land use stayed the same, the actual areas served changed because those areas served with potable water do not necessarily correspond with those areas served recycled water.

Based on discussions with the District and a review of current planning documents, it is anticipated that the use of recycled water will be limited to the following land use designations:

- Residential Medium, Medium-High, and High
- Mixed Use
- Commercial
- Industrial
- Public
- Open Space

For this Recycled Water Master Plan Update, it was assumed that residential low and low-medium designations would not receive recycled water because of the impracticality of serving the small irrigation demands associated with these land use designations, and the necessity to maintain sufficient separation between the recycled and potable water systems. Additionally, as discussed previously, portions of Central Dublin and all of Western Dublin (Priority 5 areas) were not included in this study because the total demand for Priority 1 through 4 areas, as will be shown later in this chapter, utilize all of the District's allocated recycled water supply (9.6 mgd).

Historical Recycled Water Production and Consumption

The District currently meets the recycled water demands of its irrigation customers with a mixture of recycled water produced at its MFUV Facility and potable water supplied by Zone 7 (because the MFUV Facility does not currently have the capacity to meet all of the District's recycled water demands).

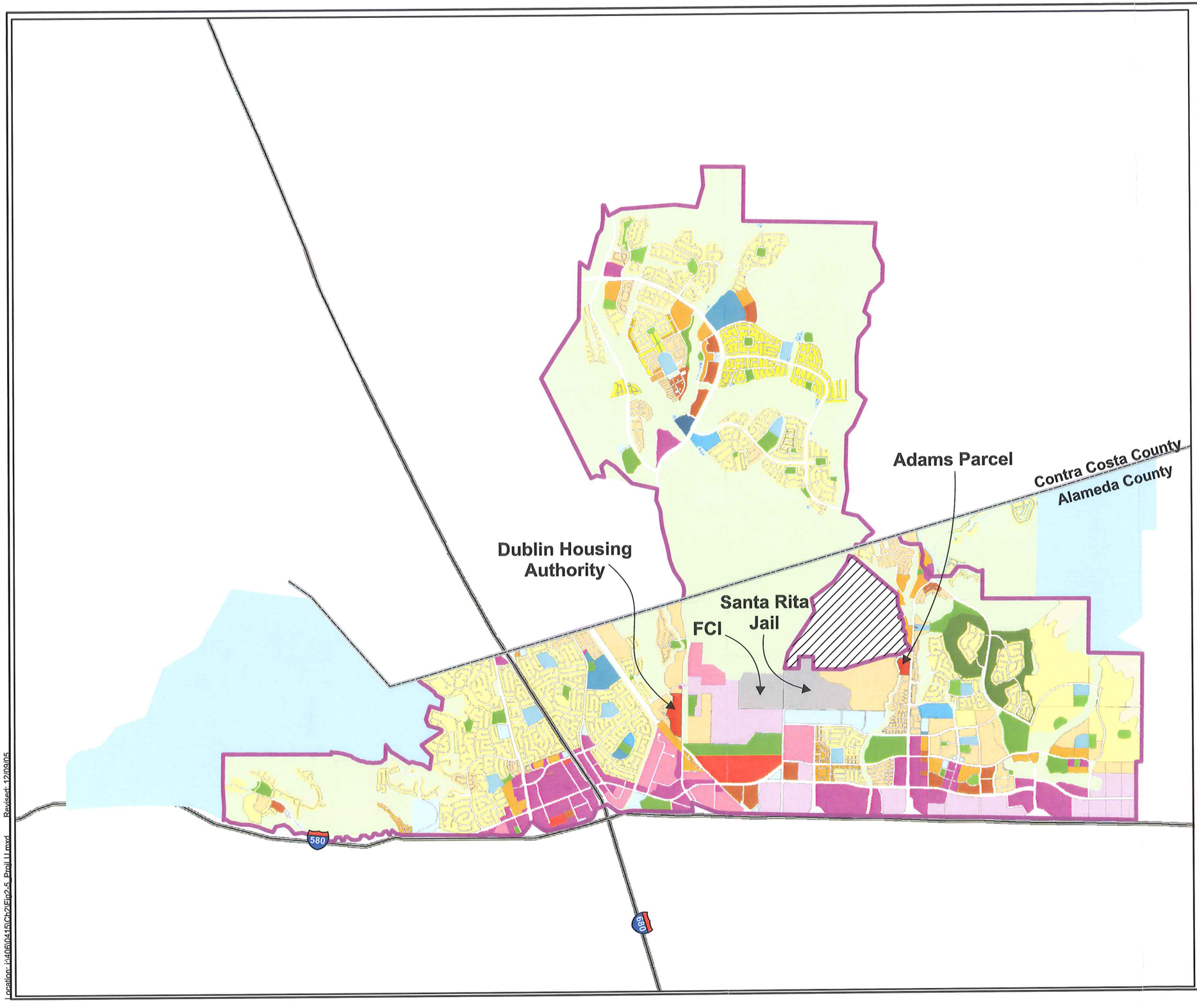
The MFUV Facility was originally constructed to reduce the District's discharge to the LAVWMA transmission line and develop a groundwater recharge program. The District board made a policy decision not to initiate the groundwater recharge program because of public reaction, even though it has the necessary permits to move forward with the program. Consequently, the District uses the MFUV Facility to meet a portion of its irrigation demand with recycled water.

Table 10-4 presents the District's historical recycled water production from the MFUV Facility and metered recycled water demand. As shown in Table 10-4, the District's MFUV Facility only produced 211 af, 392 af and 737 af of recycled water in 2002, 2003 and 2004, respectively. However, recycled water demands were 309, 749 and 1,233 af in 2002, 2003 and 2004, respectively. The District used potable water to make up the difference (211 af in 2002, 357 af in 2003, and 496 af in 2004) between its recycled water demand and supply from its MFUV Facility.

FIGURE 10-11

Dublin San Ramon Services District Water Master Plan Update

PLANNED LAND USE



N

0 0.2 0.4 0.8

Scale in Miles

LEGEND:

- Water Service Area
- Area Not Within District Service Area
- Sphere of Influence
- Area Not Served by the District
- Residential - Rural
- Residential - Low (2.1 to 5.9 du/acre)
- Residential - Low Medium (6.1 to 7.9 du/acre)
- Residential - Medium (8.0 to 12.0 du/acre)
- Residential - Medium High (13.0 to 27.0 du/acre)
- Residential - High (> 27.0 du/acre)
- Mixed Use (FAR: 0.75)
- Commercial - Retail (FAR: 0.35)
- Commercial - Office (FAR: 0.35)
- Industrial - Business Park (FAR: 0.30)
- Public - Public/Semi-Public (FAR: 0.25)
- Public - Elementary School
- Public - Middle School
- Public - High School
- Public - Community College
- Public - Jail
- Open Space - City Park/Community Center
- Open Space - Neighborhood Park
- Open Space - Golf Course
- Open Space - Open Space
- Open Space - Water
- County Line
- Interstate Highway

DUBLIN SAN RAMON SERVICES DISTRICT

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Locations: i:\06\07\415\Ch2\Fig2-5_Proj Lu.mxd Revised: 12/09/05

Table 10-4. Historic Recycled Water Production (2000-2004)

Year	Recycled Water Production, afa[a]	Metered Recycled Water Demand, afa	Difference, afa
2000	34	NA	NA
2001	44	NA	NA
2002	98[b]	309	211
2003	392[c]	749	357
2004	737[d]	1,233	496

(a) Based on total annual recycled water production by DSRSD's MFUV Facility

(b) Total recycled water demand in the City of Dublin was 309 af. However, recycled water production at DSRSD's MFUV Facility was only 98 af. The balance of the demand (211 af) was met using potable water.

(c) Total recycled water demand in the City of Dublin was 749 af. However, recycled water production at DSRSD's MFUV Facility was only 392 af. The balance of the demand (357 af) was met using potable water.

(d) Total recycled water demand in the City of Dublin was 1,233 af. However, recycled water production at DSRSD's MFUV Facility was only 737 af. The balance of the demand (496 af) was met using potable water.

NA = Not Available

As discussed in subsequent sections, the District's recycled water demand is expected to increase dramatically over the next few years. However, the District will have new recycled water supplies available through participation in the SRVRWP and DERWA. The first phase of the recycled water system (9.6 mgd) will be completed by October 2005; the second phase, if and when constructed, will provide a total of 16.5 mgd of recycled water capacity to both EBMUD and the District. However, the City of Pleasanton has indicated that its wastewater cannot be used by either the District or EBMUD and therefore, the actual supply available may be limited to approximately 10.2 mgd.

Adopted Peaking Factors

Peaking factors are used to calculate recycled water demands expected under high demand conditions. The resulting demand conditions are then allocated in the hydraulic model to evaluate and size distribution pipelines, pump stations, and storage facilities, and to define water supply needs and capacity requirements. Per the direction of District staff, WYA was directed to adopt and use the peaking factors developed and used by DERWA in our hydraulic analysis. The adopted peaking factors are presented in Table 10-5 and were obtained from the December 2003 SRVRWP Final Design Hydraulic Modeling Report.

Table 10-5. Adopted Peaking Factors[a]

Peaking Factor	DERWA Value Used in this Master Plan Update[b]	Values Used in the District's 2000 Water Master Plan[c]	Percent Difference
Irrigation Schedule Adjustment	2.4	2.67	- 10.1
Average Day to Maximum Day Demand	2.9	3.1	- 6.5

(a) Peaking factors obtained from the December 2003 SRVRWP Final Design Hydraulic Modeling Report
(b) Based on a 10-hour irrigation schedule
(c) Based on a 9-hour irrigation schedule

Table 10-5 indicates that the DERWA peaking factors are slightly lower than the peaking factors previously used in the District's 2000 Water Master Plan. The difference is partially explained by the use of a 10-hour irrigation schedule by DERWA rather than the 9-hour irrigation schedule previously used in the 2000 Water Master Plan.

Verification of the Irrigation Application Rate

WYA evaluated metered irrigation water use data available for the Dublin Sports Grounds to verify the irrigation application rate previously used by DERWA and in the 2000 Water Master Plan (42 inches per year). The Dublin Sports Grounds was the only large irrigation customer with sufficient data to complete the verification, and had a high enough irrigable area and irrigation demand to use for planning purposes.

The Dublin Sports Grounds is located east of the Dublin Library; between Dublin Boulevard and Interstate 580, and District meter records indicate it used 2,692,000 cubic feet of water in 2003. As shown on Figure 10-12, the Dublin Sports Grounds has approximately 853,800 square feet of irrigable area after deducting impervious areas such as the parking lot and bathrooms. Therefore, the application rate for the Dublin Sports Grounds is 38 inches per year (2,692,000 cubic feet divided by 853,800 feet, times 12). The calculated application rate (38 inches per year) was then rounded to 40 inches per year to produce a more conservative demand for planning purposes.

The recommended irrigation application rate (40 inches per year) is considered more accurate than the application rate previously estimated by DERWA and the District's 2000 Water Master Plan, because it is based on more recent metered data for a large irrigation customer within the District's recycled water service area.

Projected Water Demand

Total recycled water demands were projected for the District's Priority 1 through 4 areas (see Figure 10-2) at buildout, using peaking factors adopted from DERWA, an application rate of 40 inches per year, adjustment factors to account for irrigable area, adjustment factors to account for the mix of recycled and potable water used by the District, and an estimate of total acreage served

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LEGEND:

- Boundary of the Dublin Sports Grounds
- Parking Lot & Bathrooms

N

0 55 110 220

Scale in Feet

FIGURE 10-12

Dublin San Ramon Services District Water Master Plan Update

DUBLIN SPORTS GROUNDS

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recycled water by land use designation. The specific steps WYA used to calculate the District's projected recycled water demand and the results are discussed below.

Adjustment Factors Used to Project Recycled Water Demands

For this Recycled Water Master Plan Update, it was assumed that a majority of the exterior water demands, with the exception of low and low-medium density residential designations, would be met with the use of recycled water. Therefore, adjustments must be made to the acreage estimates and resulting demand estimates to account for the portion of area that is actually irrigable, and the portion of the irrigable demand that will actually be met with recycled water.

Table 10-6 presents the recommended adjustment factors by land use designation that were used to project the District's total recycled water demands. These factors were adopted from the 2000 Water Master Plan and then refined based on discussions with District staff. The only modification made to the factors previously used in the 2000 Water Master Plan included increasing the percentage of irrigation demand met with recycled water from 95 to 100 percent for parks and from 90 to 95 percent for schools. Factors for mixed use and median land use designations were also added.

Table 10-6. Adjustment Factors Used for Projecting Recycled Water Demands

Land Use Designation	Percent of Area Irrigable, %	Percent of Irrigation Demand Met with Recycled Water, %	Plant Type Irrigation Factor
Residential – Medium	30	30	0.9
Residential – Medium High	30	80	0.9
Residential – High	25	80	0.9
Mixed Use	15	100	0.9
Commercial	15	100	0.8
Industrial	20	100	0.9
Public – Public/Semi-Public	25	95	0.9
Public – Schools	50	95	0.9
Open Space – Parks	80	100	1.0
Open Space – Medians	10	100	1.0
Open Space – Golf Course	95	100	1.0
Open Space – Corridor	50	100	1.0

Identification of Potential Irrigation Customers and Projected Demand

Associated irrigable acreages by land use designation were developed based on projected land use (see Figure 10-11), a review of aerial photographs, and discussions with District staff. Figure 10-13 presents the areas and land use designations for the City of Dublin and Dougherty Valley that would likely be served with recycled water; these areas are close to infrastructure planned by DERWA.

Each of the areas identified in Figure 10-13 were then assigned to a recycled water pressure zone to help identify those areas that may potentially experience low or high pressure. Figure 10-14 illustrates the pressure zone assigned to each area. Figure 10-15 illustrates those areas that may experience low or high pressure. For those areas in the northeastern part of Dougherty Valley, located outside of Pressure Zone R300A, the developer is going to install a pump station that will boost pressures to over 40 psi in Pressure Zone R300B (see Figure 10-15); WYA's evaluation of the other areas using the hydraulic model are presented in later sections of this chapter.

Table 10-7 presents a summary of the projected recycled water demand for Priority 1 through 4 sub areas, after applying the appropriate adjustment factors. Table 10-8 presents a summary of projected recycled water demand, by pressure zone, after applying the appropriate adjustment factors. Appendix F presents a more detailed breakdown of the demand calculations by land use designation. As shown in Tables 10-7 and 10-8, the District's projected annual average day demand, maximum day demand, and maximum day demand over a 10-hour irrigation schedule is 3.3 mgd, 9.6 mgd, and 16,000 gpm, respectively. No additional recycled water supply is available for Priority 5 areas (Central and Western Dublin sub areas).

Table 10-7. Projected Recycled Water Demands by Sub area

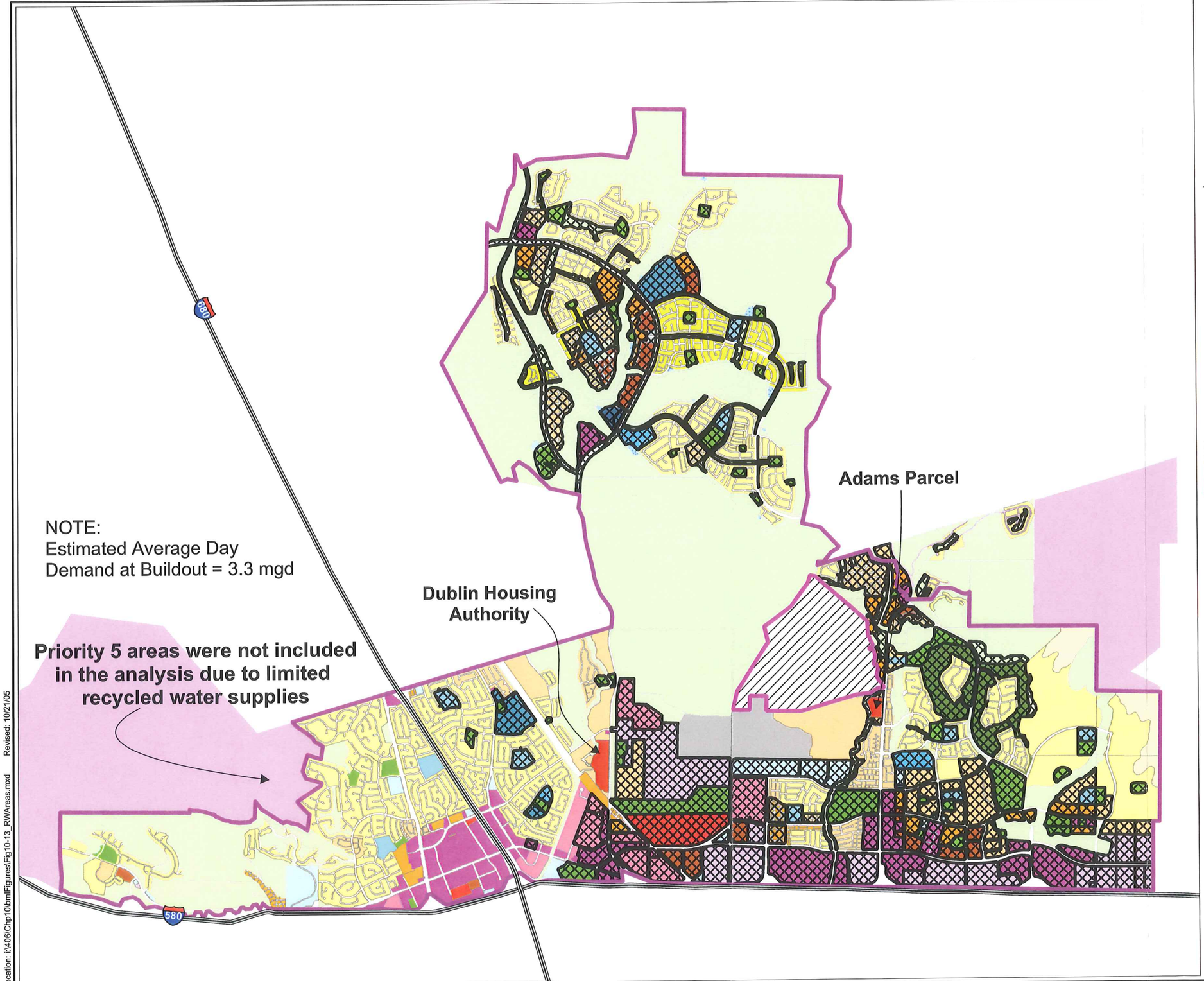
Sub area	Projected Demand, afa	Projected Average Day Demand, mgd	Projected Maximum Day Demand, mgd [(a)]	Maximum Day Demand over 10-Hours, gpm
Camp Parks – City Development	325	0.29	0.84	1,401
Camp Parks – Proper	140	0.13	0.36	600
Central Dublin	309	0.28	0.80	1,334
Eastern Dublin	2042	1.80	5.29	8,811
Dougherty Valley	883	0.79	2.29	3,812
Total	3,700	3.3	9.6	16,000

(a) The total recycled water capacity of the DERWA system at buildout is projected to be approximately 16.5 mgd, leaving approximately 6.9 mgd (16.5 – 9.6 mgd) for the EBMUD service area.

FIGURE 10-13

Dublin San Ramon Services District Water Master Plan Update

PLANNED RECYCLED WATER USE AREAS



N

0 0.15 0.3 0.6
SCALE IN MILES

LEGEND

- Area Served Recycled Water
- Recycled Water Service Area
- Area Not Within District Service Area
- Area Not Served by the District
- Residential - Rural
- Residential - Low (2.1 to 5.9 du/acre)
- Residential - Low Medium (6.1 to 7.9 du/acre)
- Residential - Medium (8.0 to 12.0 du/acre)
- Residential - Medium High (13.0 to 27.0 du/acre)
- Residential - High (> 27.0 du/acre)
- Mixed Use (FAR: 0.75)
- Commercial - Retail (FAR: 0.35)
- Commercial - Office (FAR: 0.35)
- Industrial - Business Park (FAR: 0.30)
- Public - Public/Semi-Public (FAR: 0.25)
- Public - Elementary School
- Public - Middle School
- Public - High School
- Public - Community College
- Public - Jail
- Open Space - City Park/Community Center
- Open Space - Neighborhood Park
- Open Space - Golf Course
- Open Space - Open Space
- Open Space - Water
- Sphere of Influence
- Interstate Freeway

DUBLIN SAN RAMON SERVICES DISTRICT

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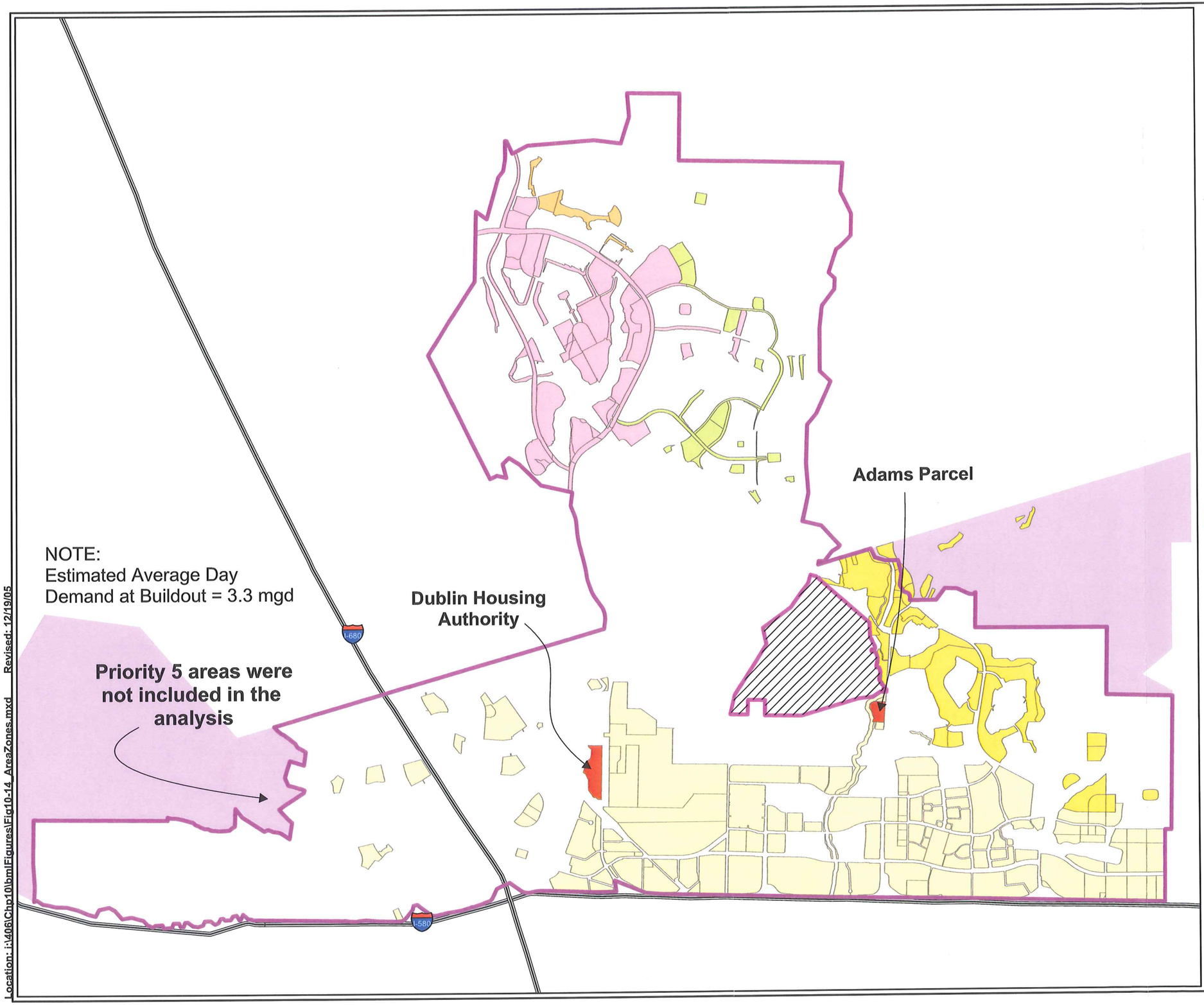
FIGURE 10-14

Dublin San Ramon Services District Water Master Plan Update

RECYCLED WATER PRESSURE ZONE ASSIGNMENT



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0 0.15 0.3 0.6

SCALE IN MILES

LEGEND

- Area Not Within District Service Area
- Pressure Zone R1
- Pressure Zone R20
- Pressure Zone R200
- Pressure Zone R300A
- Pressure Zone R300B
- Area Not Served by District
- Interstate Highway
- Sphere of Influence
- Recycled Water Service Area

DUBLIN SAN RAMON SERVICES DISTRICT

WEST YOST & ASSOCIATES

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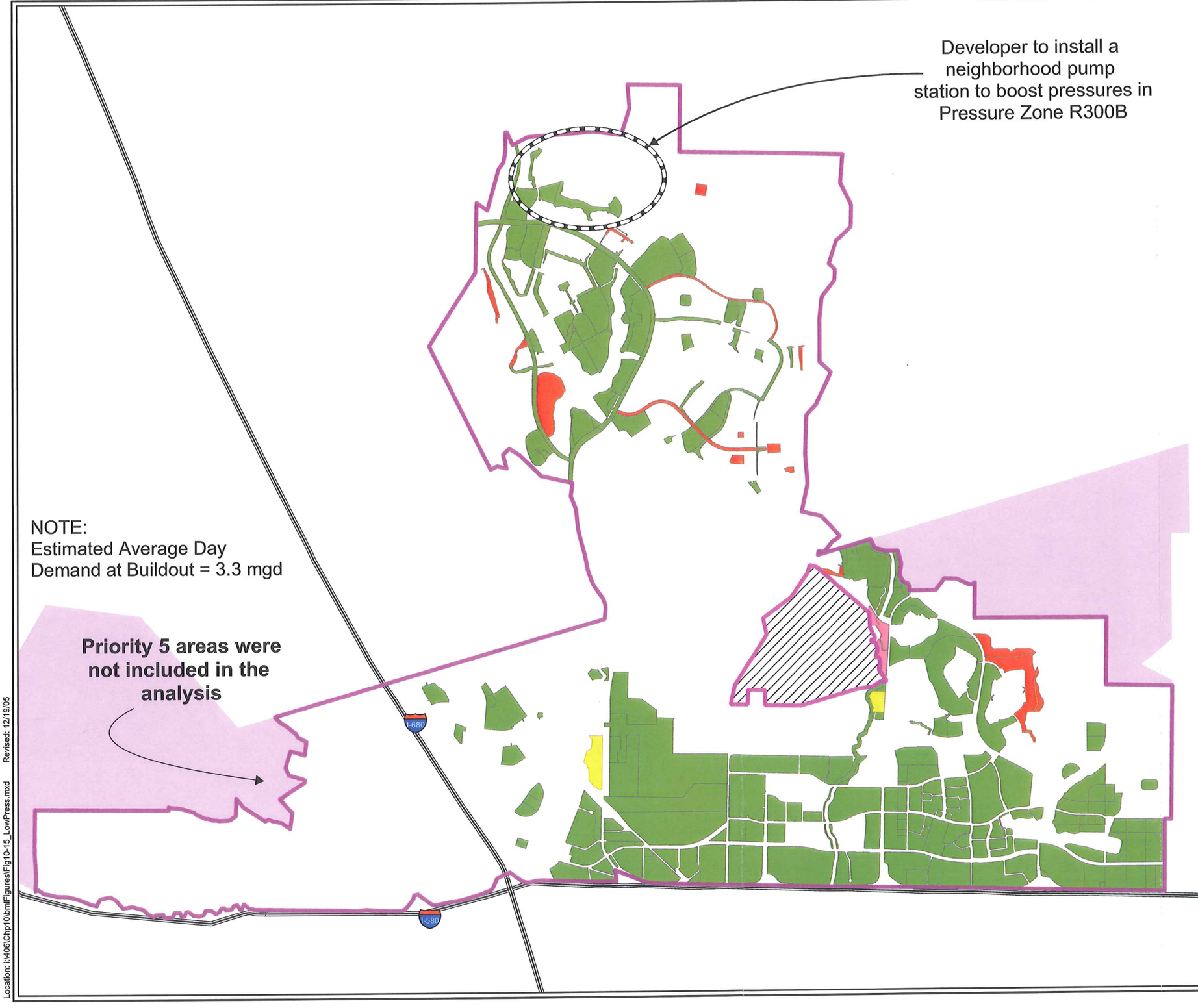
FIGURE 10-15

Dublin San Ramon Services District Water Master Plan Update

POTENTIAL LOW OR HIGH PRESSURE RECYCLED WATER USE AREAS



N

0 0.15 0.3 0.6

SCALE IN MILES

LEGEND

- Areas with Potential High Pressure
- Areas with no Identified Pressure Issue
- Areas with Potential Low Pressure
- Recycled Water Service Area
- Area Not Within District Service Area
- Area Not Served by Distrct
- Sphere of Influence
- Interstate Highway

DUBLIN SAN RAMON SERVICES DISTRICT

WEST YOST & ASSOCIATES

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Table 10-8. Projected Recycled Water Demands by Pressure Zone

Pressure Zone	Projected Demand, afa	Projected Average Day Demand, mgd	Projected Maximum Day Demand, mgd	Projected Peak Hour Demand, gpm
R1	1,777	1.60	4.6	7,677
R20	1,039	0.93	2.7	4,484
R200	585	0.50	1.5	2,524
R300A	204	0.18	0.53	879
R300B	95	0.08	0.25	409
Total	3,700	3.3	9.6	16,000

Comparison to the District's 2000 Water Master Plan

Table 10-9 compares the projected annual average day recycled water demands for Priority 1 through 4 sub areas with those projected for the same areas in the 2000 Water Master Plan and in the December 2003 Final Design Hydraulic Modeling Report completed for DERWA. As shown in Table 10-9, the new total recycled water demand projection (3.3 mgd) is the same as the DERWA projections, and the projections made in the 2000 Water Master Plan. However, projections for specific sub areas have changed significantly. The new sub area projections are different from previous projections because of the following reasons:

1. Tentative maps recently provided by the developer for the Shapell Development in Dougherty Valley indicate that a large park, previously estimated as having a potential recycled water demand of 0.7 mgd, will no longer be constructed,
2. The recycled water demand peaking factors used by DERWA, which have been adopted for use in this study, are lower than the peaking factors previously used in the 2000 Water Master Plan, and
3. The irrigation application rate used (40 inches per year) in this study is lower than the previously used application rate of 42 inches per year.

Table 10-9. Comparison to Previous Recycled Water Demand Projections[a]

Location[b]	DERWA, mgd[c]	2000 Water Master Plan, mgd[d]	New Projection, mgd	Percent Difference from 2000 Water Master Plan, %
Camp Parks	0.4	0.4	0.4	0
Central Dublin	0.2	0.5	0.3	-40
Eastern Dublin	1.6	1.3	1.8	+38
Dougherty Valley	1.1	1.1	0.8	-27
Total	3.3	3.3	3.3	0

(a) Based on annual average day demand
(b) Camp Parks – City Development and Camp Parks Proper were combined into one category for comparison
(c) Obtained from Table 2 of the December 2003 Final Design Hydraulic Modeling Report
(d) Based on Scenario 5 of Table 10-8 of the 2000 Water Master Plan

Peak Demand Conditions and Timing

Based on information provided by the District, buildout of the Windemere Development in (Dougherty Valley), the Shapell Development (Dougherty Valley), and the City of Dublin is expected to occur by 2010, 2015, and 2020, respectively. Using these timeframes and the proportionate increase in population by year presented in the 2005 Urban Water Management Plan Update, WYA developed recycled water demand projections for 2005, 2010, 2015, and 2020. Table 10-10 presents the projected recycled water demands in five-year increments.

Table 10-10. Projected Recycled Water Demands by Year

Year	Average Day Demand, mgd	Maximum Day Demand, mgd[a]	10-Hour Irrigation Schedule, gpm[b]	Comment[c]
2004	1.1	3.2	5,320	
2005	1.8	5.1	8,500	
2010	2.3	6.8	11,300	Buildout of Windemere
2015	2.9	8.4	14,000	Buildout of Shapell
2020	3.3	9.6	16,000	Buildout of City of Dublin

(a) Based on a DERWA peaking factor of 2.9 times the average day demand
(b) Based on a DERWA peaking factor of 2.4 times the maximum day demand, converted to gpm
(c) Anticipated year of buildout provided by the District

As shown on Table 10-10, the District's recycled water demand is projected to increase from 1.1 mgd (1,230 af) in 2004 to 1.8 mgd in 2005; representing a 64 percent increase in the District's recycled water demand. Table 10-10 also shows that the District's recycled water demands are projected to increase from 1.8 mgd in 2005 to 3.3 mgd by 2020. This represents an 83 percent increase in recycled water demand over the next 15 years.

The increase in recycled water use is the result of major recycled water facilities coming online that will enable the District to serve a larger portion of its existing landscape irrigation demand with recycled water, and landscape irrigation demands associated with the development of Dougherty Valley, Eastern Dublin and Camp Parks.

WYA also projected recycled water demands by year for each sub area and each pressure zone. Figure 10-16 illustrates projected, recycled water demands by sub area and Figure 10-17 illustrates projected, recycled water demands by pressure zone. As shown on Figure 10-16, recycled water demands in Dougherty Valley and Eastern Dublin account for the largest increases in recycled water demands before 2015, and recycled water demands in Camp Parks account for the largest increase in recycled water demands beyond 2015. Central Dublin also experiences a slight increase in projected recycled water demands. Phasing recommendations for planned infrastructure depend on timing.

As shown on Figure 10-17, recycled water Pressure Zones R1, R20, and R200 account for the largest increase in recycled water demand over time. This corresponds with the observations made for Figure 10-16 as R1 contains Camp Parks, R20 contains Eastern Dublin, and R200 contains the largest portion of Dougherty Valley. Although R300A and R300B will also experience significant increases in projected recycled water demands, the rate of increase for both areas is smaller.

RECYCLED WATER OPERATIONAL AND DESIGN CRITERIA

Standard operational and design criteria are necessary to properly evaluate the recycled water system from a pressure, flow, redundancy, and reliability standpoint. As directed by District staff, this Recycled Water Master Plan Update adopted the operational and design criteria used in recent modeling efforts completed by DERWA.

The following describes the operational and design criteria from recent DERWA modeling efforts used in this Recycled Water Master Plan Update:

- Recycled Water System Demand Conditions
- Recycled Water System Pumping Criteria
- Recycled Water System Storage Criteria
- Recycled Water System Pipeline Criteria

The operational and design criteria used in this Recycled Water Master Plan Update for the recycled water system are summarized in Table 10-11.

Figure 10-16. Projected Recycled Water Demands: by Sub-Area

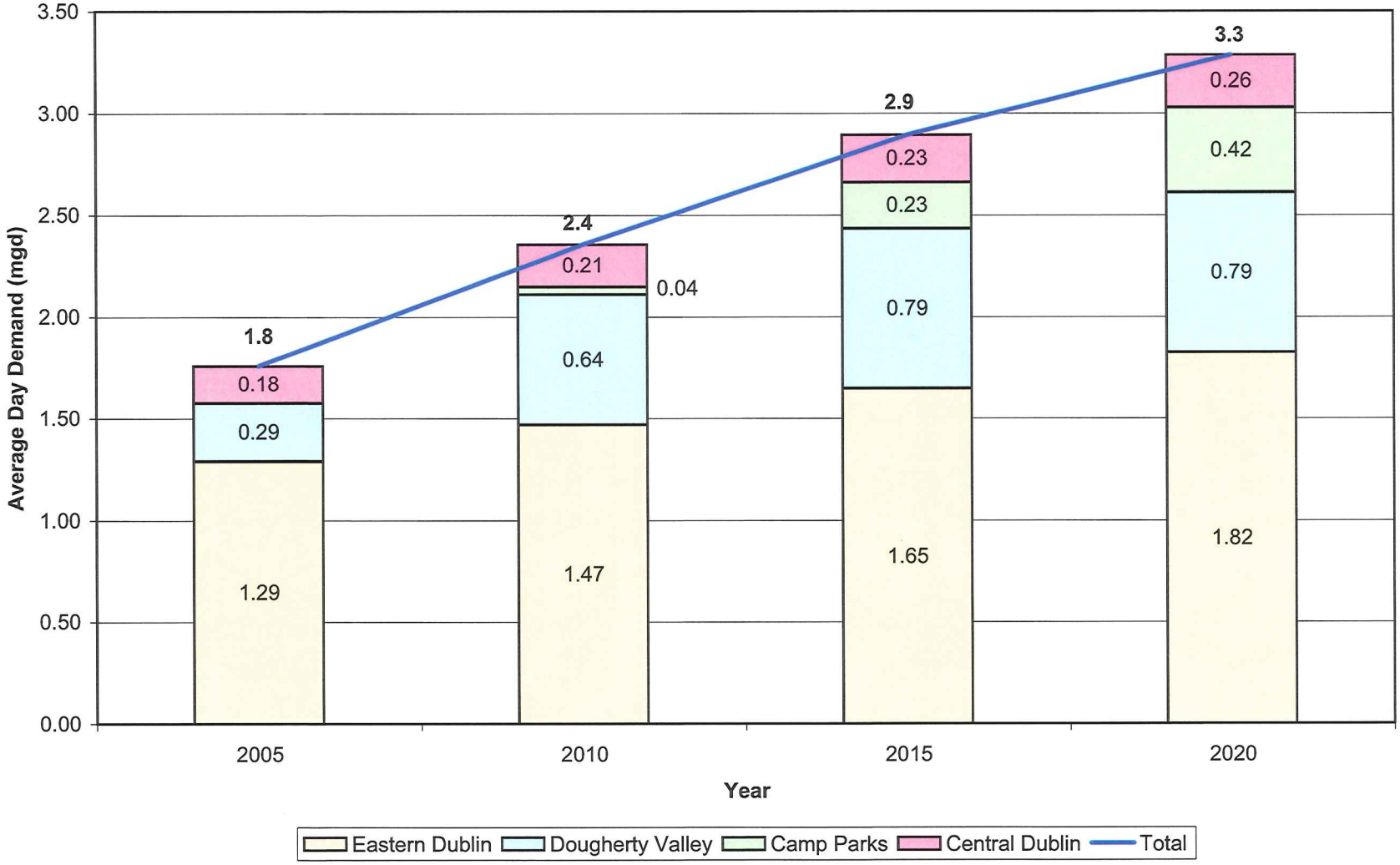

Figure 10-17. Projected Recycled Water Demands: by Pressure Zone

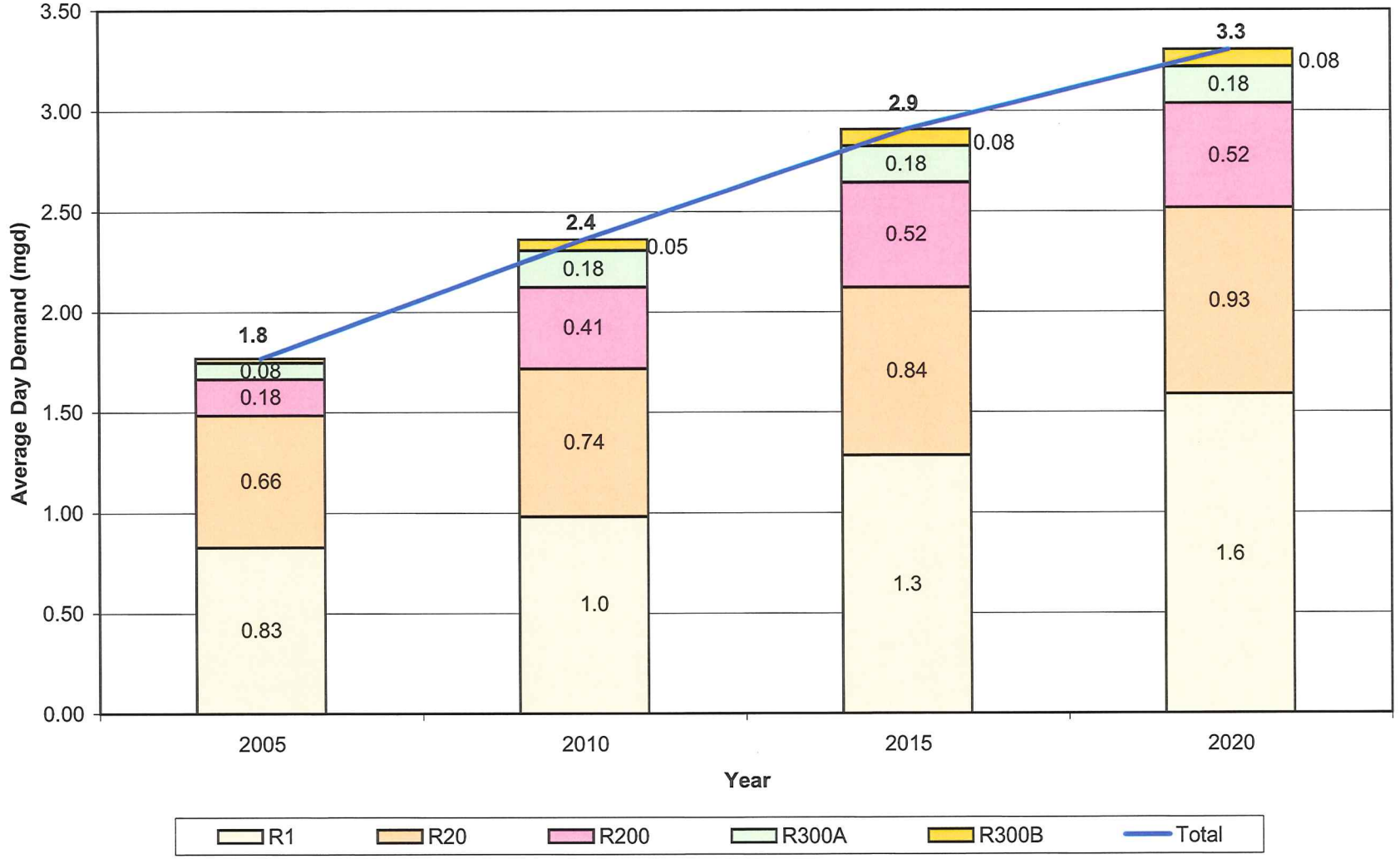

Table 10-11. Recommended Recycled Water Operational and Design Criteria [a]

Component	Criteria
Pump Stations	
Capacity	Provide maximum day demand (without storage reservoirs) while allowing storage reservoirs to fill within 14-hour period with no untreated demands
Facility	Equipped with a plug in adapter to allow interconnection to a portable generator
Storage Reservoirs	
Sizing Criteria [b]	Larger of the following: Storage required to meet operation needs on the maximum day plus 10% contingency 64% of maximum day demand
Pipelines	
Customer Line Pressure, psi[c]	40 – 125
DERWA Line Pressure, psi	40 – 200
Maximum Velocity, ft/sec	10
Minimum diameter	4-inch
Hazen Williams "C"	130

[a] Design criteria obtained from Appendix A of the April 9, 2001, TM entitled, "5.7 mgd (3.3 mgd DSRSD/2.4 mgd EBMUD) DERWA System Hydraulic Model and Base Project Cost.

[b] Design criteria obtained from Appendix A of the April 9, 2001, TM entitled, "5.7 mgd (3.3 mgd DSRSD/2.4 mgd EBMUD) DERWA System Hydraulic Model and Base Project Cost.

[c] Pressure assumed at the pad elevation, which is assumed to be no greater than 20 feet above the pipeline main.

Recycled Water System Demand Conditions

Previous DERWA modeling efforts used two demand conditions to evaluate proposed recycled water system infrastructure: maximum day demand and peak hour demand.

Maximum Day Demand

The recycled water supply system shall have the capability to meet a system demand condition equal to the occurrence of a maximum day demand condition, within a 10-hour irrigation period. DERWA guidelines presented in the December 2003 Final Design Hydraulic Modeling Technical Memorandum (Modeling TM) state this demand condition is equal to 2.9 times the projected average day demand.

Maximum Day Demand Over 10-Hours

The recycled water supply system shall also have the capability to meet a system demand equal to the occurrence of a peak hour demand condition, within a 10-hour irrigation period. DERWA guidelines presented in the Modeling TM state this demand condition is equal to 6.9 times the average day demand.

Recycled Water System Pumping Criteria

The pump stations within the recycled water system shall be planned and designed to meet capacity and facility requirements necessary to ensure they can reliably meet the required recycled water demand conditions.

Recycled Pumping Capacity Requirements

DERWA guidelines for pump station capacity presented in the October 2001 Summary Memorandum require that pump stations must meet the following capacity requirements:

- Sufficient pumping capacity shall be provided so that the maximum day demand can be supplied without assistance from storage tanks.
- Sufficient pumping capacity shall be provided so that storage tanks can be filled within the 14-hour period during which no untreated (recycled) water demands are expected to occur.

Per direction from District staff, these capacity requirements, as adopted by DERWA, were used in this Recycled Water Master Plan Update.

Recycled Pumping Facility Requirements

Based on a review of District standards and discussions with District staff, it was assumed in this Recycled Water Master Plan Update that all recycled water pump stations would be equipped with a plug-in adapter to allow interconnection to a portable generator. This requirement will improve the reliability of the recycled water system during a prolonged power outage.

Recycled Water System Storage Criteria

DERWA guidelines for storage tank capacity presented in the October 2001 Summary Memorandum require that tanks be sized to meet the larger of the following two capacity requirements:

- Storage required to meet operational needs, plus a 10 percent contingency, or
- 64 percent of the maximum day demand.

Per direction from District staff, these capacity requirements, as adopted by DERWA, were used in this Recycled Water Master Plan Update; however, the criteria specified did not indicate whether the operational needs or maximum day demand was for the entire service area or for an individual pressure zone. This Recycled Water Master Plan Update assumed that storage was required to meet the needs or maximum day demand for the individual pressure zone.

Recycled Water System Pipeline Criteria

DERWA guidelines for recycled system pipelines presented in the October 2001 Summary Memorandum require that pipelines be sized to meet the following requirements during either a maximum day demand or peak hour demand condition:

- Service pressures for customers within the system shall be maintained between a maximum of 125 psi and a minimum of 40 psi
- Service pressures for DERWA lines shall be maintained between a maximum of 200 psi and a minimum of 40 psi
- Velocities within the recycled water system shall be limited to 10 fps
- Pipelines shall not be sized smaller than 4 inches in diameter
- Hazen Williams coefficient ("C" factor) shall be assumed equal to 130
- Minor losses shall be included

The DERWA guidelines did not include pipeline head loss (i.e., major friction loss) as a design criteria; consequently, the head loss criteria previously used in the 2000 Water Master Plan (15 ft/kft) was used.

DEVELOPMENT OF THE RECYCLED WATER MODEL

The purpose of this section is to present an overview of the methodology used for the development of the hydraulic network model of the recycled water system to allow simulations of various future flow conditions (i.e., maximum day and peak hour). More specifically, this section describes the following in more detail:

- Description of the Model
- Modeling Element Definition and Input Requirements
- Hydraulic Model Element Naming Scheme
- Key Model Element Data Sources
- Recycled Water Demand Allocation

Description of the Model

H_2ONET was the hydraulic modeling software used to represent the recycled water system. This computer simulation model transforms information about the physical system into a mathematical model that solves for various flow conditions, and for each set of specified demands, the computer model generates information on pressure, flow, velocity and head loss that is used to analyze the system performance and identify system deficiencies. The model can also be used to verify the adequacy of recommended or proposed system improvements.

Modeling Element Definition and Input Requirements

The recycled water distribution system is represented in the model as a skeletonized network of nodes (e.g., location where pressure is monitored), and node-connecting elements (e.g., pipes). A description of nodes and node-connection elements are described as follows:

Nodes: Nodes represent a transition in pipeline characteristic (e.g., diameter) or a point in the system where pressure or water quality is monitored. Elevation and location are normally the only data requirements for nodes.

Junctions: Junctions are nodes that represent locations in the system where water is added (inflow) or subtracted (water demands) from the system. The water demand at each junction, in addition to elevation and location, are normally the only data requirements for junctions.

Links: Links (i.e., pipelines) represent facilities that convey recycled water from one point in the system to another. Diameter, from/to node or junction, and roughness are normally the only data requirements for links.

Reservoirs: Tanks are nodes that represent infinite external sources of water for the model (e.g., lake, groundwater well or treatment plant), remain at a constant water level irrespective of the flow unless they are specified as variable-head tanks, and have unlimited volume. Tanks are generally used to represent a lake or other inexhaustible supply source (e.g., wastewater treatment plant). Location and water surface elevation are normally the only data requirements for tanks.

Storage Tanks: Storage tanks are also nodes, but are distinguished from tanks by having a known finite volume and water surface levels that change with time as water flows into or out of them. These model elements are normally used to simulate the existing tanks. Diameter, bottom elevation, overflow elevation, and location are normally the only data requirements for storage tanks.

Pump: Pumps are nodes that represent locations in the model where the HGL is raised to overcome elevation differences and friction losses, and are normally used to represent a pump station (e.g., Pump Station R20). Elevation, diameter, number of pumps, pump test, pump curve, and sequencing are normally the only data required for pumps.

Hydraulic Model Element Naming Scheme

Each element in the hydraulic model of the recycled water system was given a label, which can then be used to identify the type of model element, the element's purpose, and the element's location. Table 10-12 presents the naming scheme, including the prefix for each model element used to represent it in the District's recycled water system model.

Table 10-12. Prefix Designations for Network Elements

Element	Prefix	Type	Description
Junction	J	Node	Removes (demand) or adds (inflow) water from/to the system
Node	N	Node	Represents transition in pipeline characteristic or point where pressure or water quality is monitored
Tank	T	Node	Represents storage capacity
Tank	R	Node	Represents an infinite external source Tank
Pump	PMP	Node	Raises the hydraulic grade to overcome elevation differences and friction losses
Control Valves	CV	Node	Controls flow or pressure in the system based on specified criteria
Pipelines	P	Link	Conveys water from one node to another

In addition to the prefix, a sequential number corresponding to the facility and its pressure zone was added to each element as it was created in the model. Table 10-13 summarizes the sequential numbering scheme used in the development of the District's recycled water system model.

Table 10-13. Numbering Scheme for Nodes and Pipelines

Description	Node/Pipeline Number
Nodes	1-99
Pump Facilities	100-199
Valves (meters, gate, pressure reducing, etc.)	200-299
Tanks	800-899
Tanks	900-999
Pressure Zone R1	1000-1999
Pressure Zone R20	2000-2999
Pressure Zone R200	3000-3999
Pressure Zone R300A	4000-4999
Pressure Zone R300B	5000-5999
EBMUD	6000-6999

Key Model Assumptions and Data Sources

Establishing computer modeling assumptions and criteria was important for interpreting the results of the computer simulations. The assumptions and criteria used for the District's recycled water distribution system hydraulic model are described below:

- Information on pipe length, diameter, material type and age was extracted from the District's existing GIS, and was compared for accuracy to the District's hard-copy maps, then further supplemented with developer maps.
- Pipe C-factor values were assigned based on age and pipe material, and assumed equal to 130 if no information were available.
- Information on pump station piping configurations, performance curves, and motor size were acquired from site visits, "as-built" plans, and the District operational staff.
- Pipe length accuracy was assumed to be ±25 feet.
- Ground surface elevations were estimated using available, digital topographic maps and surveyed benchmark elevations. Elevations were estimated to the nearest foot where spot elevations were not available.
- As directed by DSRSD staff, the diurnal curve used in the model included serving the maximum day demand over a 10-hour period (i.e., the maximum hour for 10 hours), and ending with 14 hours of no demand while storage tanks are refilled.
- The water demands in the model were expressed in gpm.

Recycled Water Demand Allocation

Future water demands were assigned to the District's hydraulic model using digital land use maps developed from WYA's GIS system. The actual land use map used to allocate demands was previously presented as Figure 10-13.

Using Demand Allocation Pro™, the future demands were automatically calculated based upon a direct spatial intersection between demand categorization polygons (land use polygons from Figure 10-13) and the demand node area coverage polygons (service area polygons). The service area polygons were created using the Thiessen polygon generation capability provided by Demand Allocation Pro™. This feature allowed WYA to automatically create a distinct service area polygon (contributing area) for each demand node. Thiessen polygons provided a means to divide an area into polygons by creating regions that bisect known points. These polygons typically signify the bounded region closest to each of the nodes.

Future water demands were then distributed throughout the recycled water model by assigning the calculated water demands to the network junction nodes. Considerable effort was involved in assigning water demands to the individual pressure zones and junction nodes.

ANALYSIS OF THE RECYCLED WATER DISTRIBUTION SYSTEM

The purpose of this section is to present WYA's evaluation of the recycled water system at buildout, and its ability to meet the performance and planning criteria adopted by DERWA under peak hour and maximum day demand conditions. Furthermore, District staff requested that WYA evaluate the ability of the proposed recycled water system to operate with pump stations running at a constant rate for 24 hours, instead of running at higher rates during peak demand periods.

WYA stressed the recycled water system under the following four scenarios to evaluate whether it could meet adopted performance and planning criteria:

- Scenario 1: Peak Hour Demand Condition without Pump Stations
- Scenario 2: Tank Fill Condition with Zero Demands on the System
- Scenario 3: EPS Model Run of System as Planned
- Scenario 4: EPS Model Run with Pressure Zone R300A & B Connected

Scenario 1 examines the situation in which the District would need to meet the peak hour condition using only the tanks; this condition may result if the District needed to turnover tanks, or pump stations were inoperable. Scenario 2 examines the case where the 10-hour irrigation period is over and the pump stations must refill the storage tanks; this case will produce the highest pressures system wide. Scenario 3 is a "real-time" evaluation of the entire recycled water system over a 24-hour period, allowing analysis of velocities, pressures, and head loss during both a maximum day and peak hour condition, and verification of whether the existing storage tanks can function properly while having all the pump stations operate continuously. Scenario 4 reviews the potential for connecting Pressure Zones R300A and R300B.

Each of the scenarios listed and the results of the modeling effort are discussed in more detail below. Modeling results for those portions of the DERWA system located within EBMUD's service area are not discussed.

Scenario 1: Max Day Demand Over a 10-hour Period with Tanks Only

The purpose of this steady-state model run (labeled as "STATIC 1" in the model) was to identify areas within the recycled water system in which velocity, minimum and maximum pressures, or head loss did not meet the performance and design criteria during a peak hour condition using only storage tanks. Although the recycled water system was found adequate to meet the maximum velocity criteria, it did not meet the criteria for minimum and maximum pressures, or head loss. Figure 10-18 presents a summary of pressures and head loss for the recycled water system, along with velocities for District pipelines that exceed the maximum head loss criteria.

Low and High Pressures in the System

As shown in Figure 10-18, low and high pressures observed in the recycled water system under this scenario were grouped into either Category 1 (caused by elevation) or Category 2 (caused by cumulative head loss). Any service located less than 92 feet (~ 40 psi) below the bottom elevation of the tank serving it, will have low pressures, while any service located more than 288 feet

FIGURE 10-18

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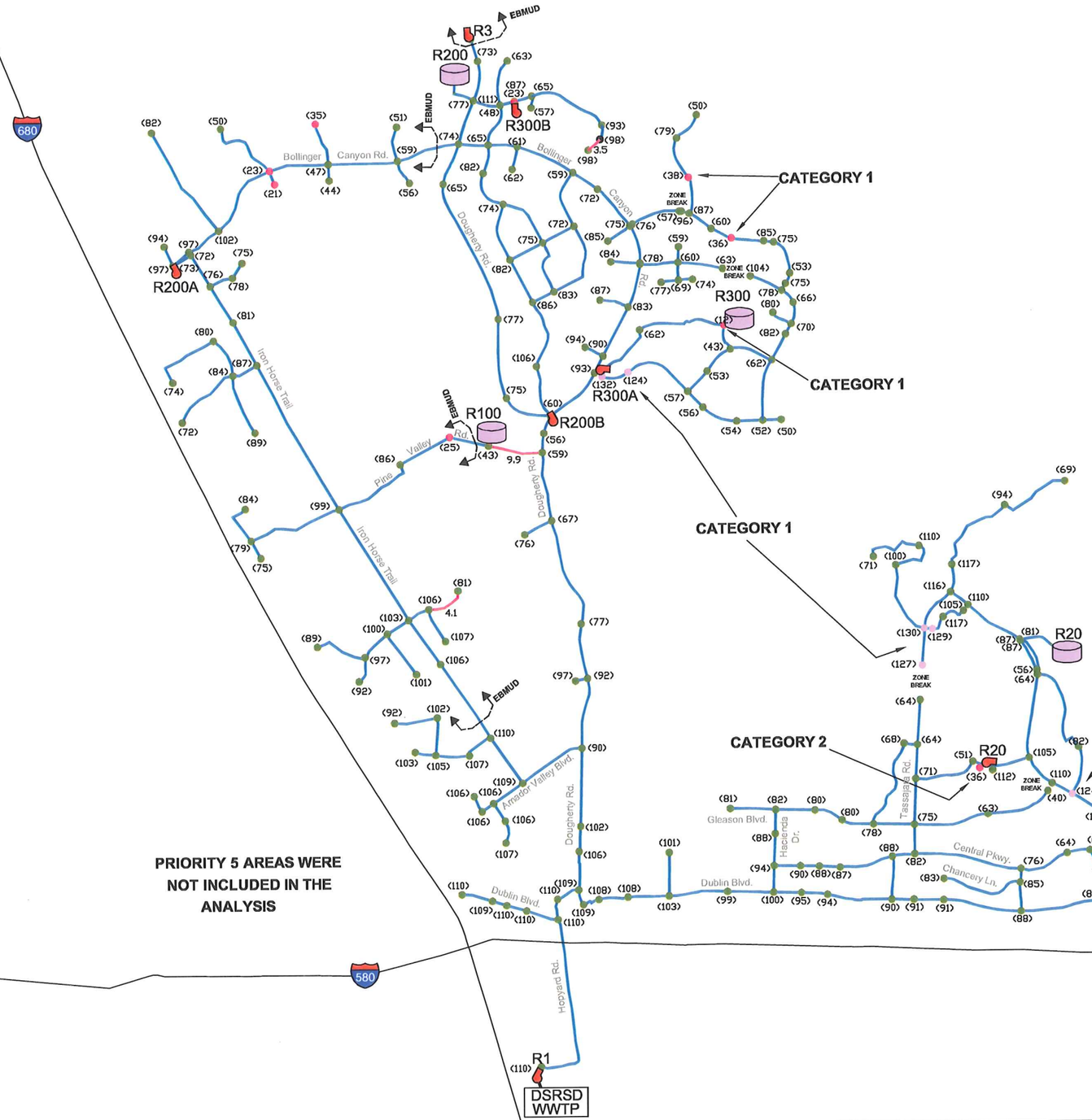
MAX HOUR DEMANDS WITH TANKS ONLY PRESSURE, VELOCITY AND HEADLOSS



0 0.375 0.75
SCALE IN MILES

NOTES:

5.8 Pipeline Velocity, ft/sec

(29) Pressure, psi

CATEGORY 1: Elevation Related

CATEGORY 2: Cumulative Headloss

LEGEND:

- Less than 40 psi
- 40 to 124 psi
- Greater than 124 psi
- HL/1000 < 15 ft/kft
- HL/1000 > 15 ft/kft

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(~125 psi) below the bottom of the tank will have high pressures. All services located less than 92 feet below or more than 288 feet below the bottom elevation of tank were placed into Category 1. If low pressures were observed in the system, and these low pressures were a result of the cumulative head loss in pipelines serving that particular connection point, this location was placed into Category 2.

The District has plans to install PRVs for all customers within Pressure Zones R1 and R20, while the developers are responsible for installing PRVs in Dougherty Valley. Consequently, Category 1 locations with pressures above 100 psi will be addressed by the District's PRV program. The two Category 1 locations with pressures below 40 psi (see area east of Bollinger Canyon Road and north of tank R300 on Figure 10-18) cannot be addressed without adding a booster pump or lowering the grade; WYA recommends the District require the developer to install small irrigation booster pumps.

Of the three Category 2 locations, only two are not connected to existing pipelines; consequently, it is recommended that the pipeline along Upper Loop Road (see Figure 10-18) be upsized from 6-inches to 10-inches in diameter, and that the pipeline along Fallon Road between Central Parkway and Dublin Boulevard be upsized from 6-inches to 10-inches in diameter. The third Category 2 location is located on the suction side of Pressure Zone R20, which has no demand, and because it is an existing pipeline, it is recommended that no changes to the system be made.

High Head loss in the System

Figure 10-18 also indicates that three pipelines within the recycled water system exceeded the performance and planning criteria for head loss (15 ft/kft); these pipelines have already been constructed. However, as illustrated on Figure 10-18, the velocity observed within the existing pipelines are more than adequate to maintain pressures and therefore, the large head loss is considered negligible.

Scenario 2: Tank Fill Condition with Zero Demands on the System

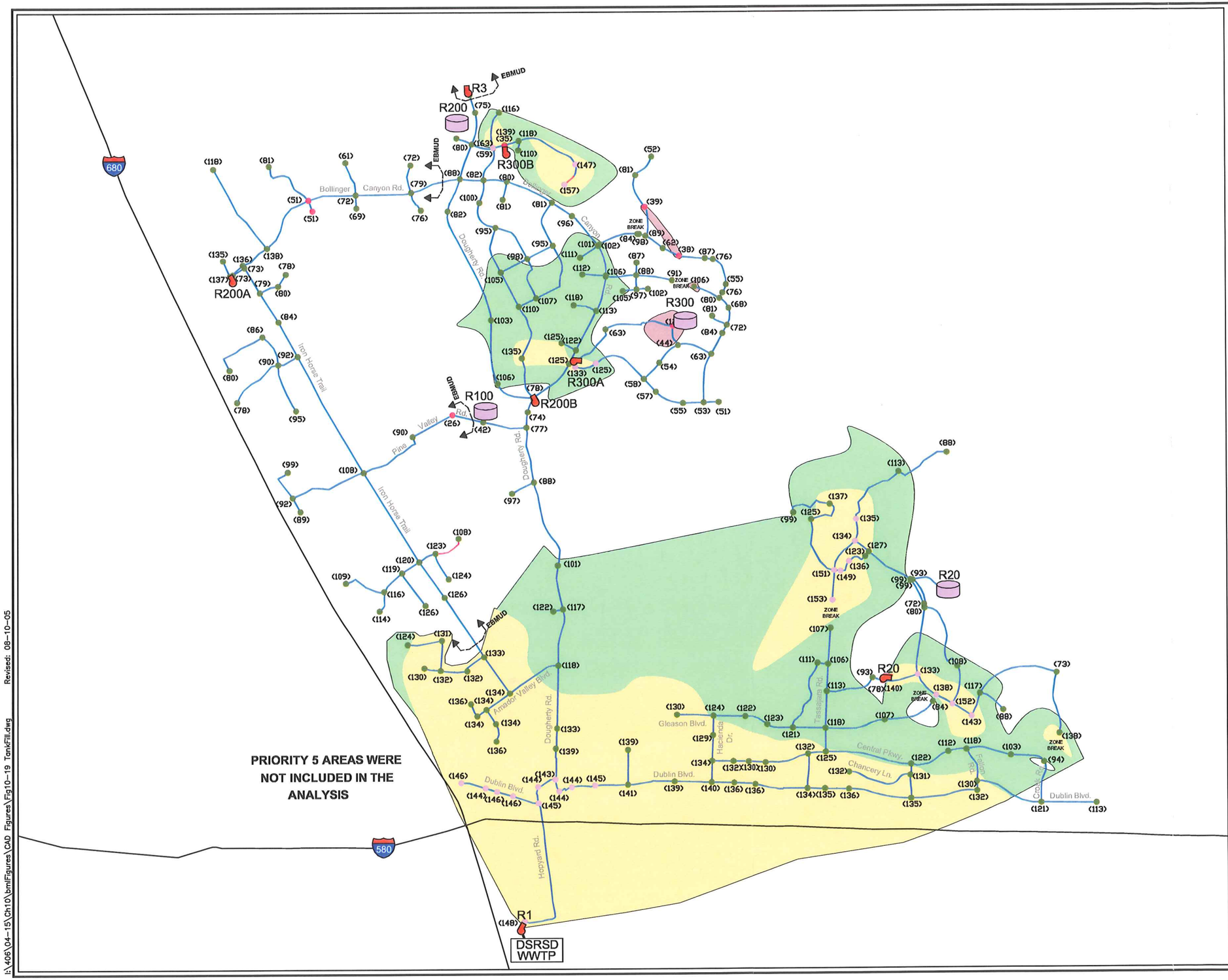
The purpose of this steady state model run (labeled as "STATIC 2" in the model) was to identify areas within the recycled water system in which velocity, minimum and maximum pressures, or head loss did not meet the performance and design criteria during tank fill conditions. Although the recycled water system was found adequate to meet the maximum velocity and head loss criteria, it did not meet the criteria for minimum or maximum pressures. Figure 10-19 presents a pressure contour map and summarizes pressures system wide.

As shown in Figure 10-19, nearly all of Pressure Zones R1, R20, R300B, and a small portion of Pressure Zone R300A experienced pressures greater than 100 psi, and the same areas in Dougherty Valley that experienced low pressures in Scenario 1, also experienced low pressures under this scenario. However, the District has plans to install PRVs for existing customers within Pressure Zone R1 and R20, and the developers are responsible for installing PRVs in Dougherty Valley, as the District will require PRVs on all customer facilities in the future.

FIGURE 10-19

Dublin San Ramon Services District Water Master Plan Update

TANK FILL CONDITION PRESSURE, VELOCITY AND HEADLOSS



0 0.375 0.75
SCALE IN MILES

NOTES:

(68) Pressure, psi

LEGEND:

- Less than 40 psi
- 40 to 124 psi
- Greater than 124 psi
- Greater than 125 psi
- 100 to 125 psi
- Less Than 40 psi

DUBLIN SAN RAMON SERVICES DISTRICT

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As discussed previously, the low-pressure areas in Dougherty Valley (illustrated on Figure 10-19) also experienced low pressures in Scenario 1, which is caused by the elevation of those particular services being less than 92 feet (~40 psi) below the bottom elevation of Tank R300. These low pressures are unavoidable without additional booster pumps and therefore, it is recommended that the District require the developer to install additional booster pumping capacity for any new services in these locations.

Scenario 3: EPS Model Run of System as Planned

The purpose of this EPS model run (labeled as "EPSMODEL" in the model") was to evaluate the system velocity, pressures, and head loss of the planned system, and identify whether or not the District can obtain turnover in the existing storage tanks while operating the pump stations at a constant flow for 24 hours.

After discussion with District staff, it was decided that a demand curve should emulate flows that provide the entire maximum day demand within 10 hours (i.e., provide the maximum hour for 10 hours), and 14 hours with no demand. Figure 10-20 illustrates the demand curve used in the EPS model run. The velocity, pressure and head loss results, followed by the storage tank evaluation are discussed in more detail below.

EPS Model Results for Velocity, Pressure, and Head loss

The EPS model results indicated that the recycled water system can adequately meet the performance and planning criteria for velocity, but not for pressures or head loss. However, the same services that experienced low or high pressures in Scenarios 1 and 2, and the same pipelines that experienced high head loss in Scenario 1, were also observed in the EPS model run. Consequently, the fixes recommended for Scenarios 1 and 2, also apply to the EPS model run.

EPS Model Storage Tank Evaluation

Figures 10-21 through 10-24 illustrate tank levels over time for Tanks R20, R100, R200, and R300, respectively, assuming the pump stations operate for 24 hours at a nearly constant rate. As shown in Figures 10-21 through 10-24, all of the storage tanks turn over (i.e., use 40 to 50 percent of the available storage) given the operational strategy modeled.

Scenario 4: EPS Model Run with Pressure Zones R300A and R300B Connected

The purpose of this EPS model run (labeled as "EPSMODEL2") was to address a District request that WYA evaluate whether Pressure Zones R300A and R300B can be inter-connected using an existing conduit located along Japonica Way. Hydraulic modeling results indicate that a 10-inch diameter pipeline installed in the conduit is necessary to connect these two pressure zones. The modeling analysis also indicated that Pump Station R300B can be operated in conjunction with Tank R300 to serve Pressure Zones R300A and R300B; however, Pump Station R300A in conjunction with Tank R300 cannot serve both pressure zones.

Figure 10-20. Demand Pattern Used in the EPS Model

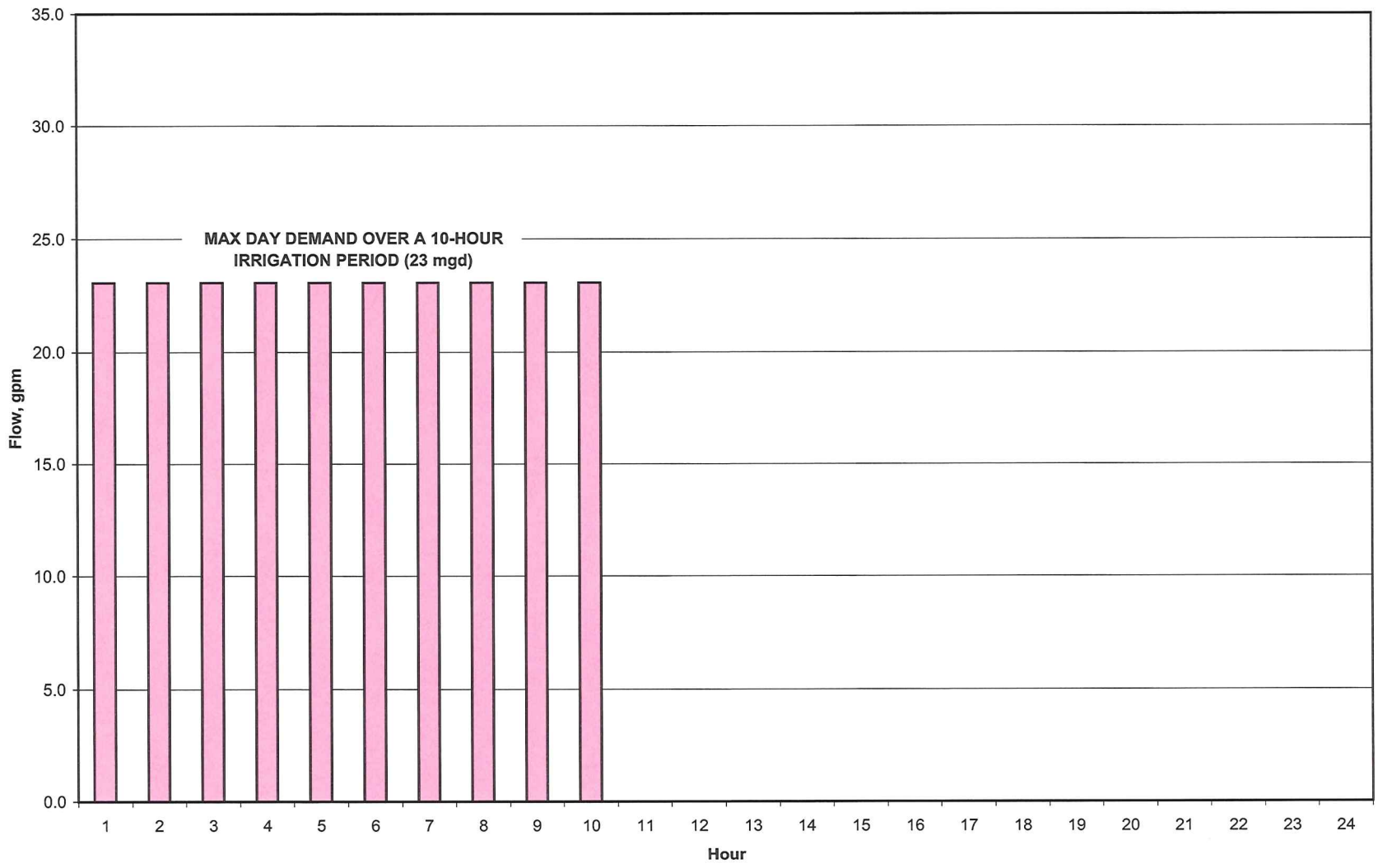


Figure 10-21. Simulated Water Levels in Tank R20

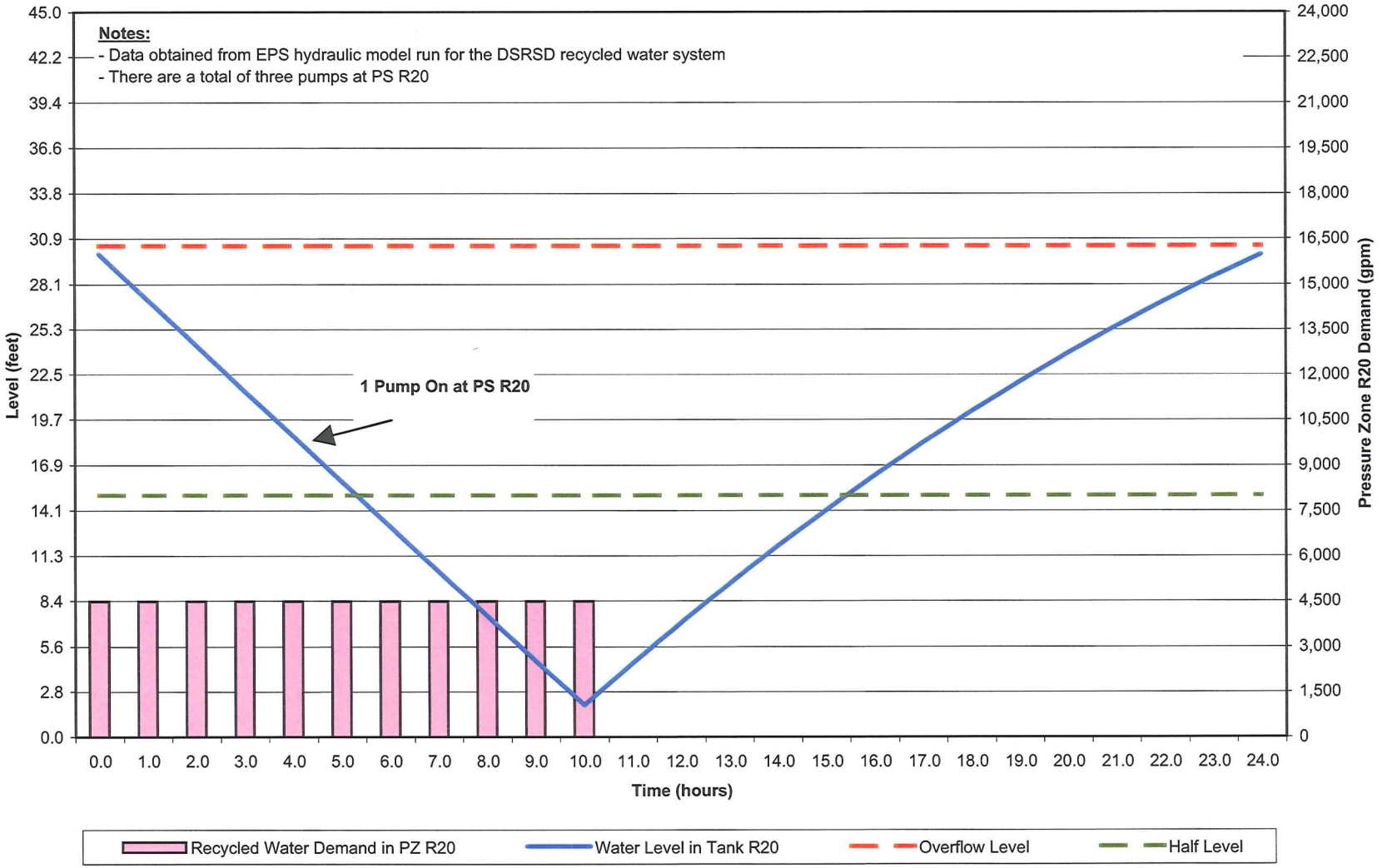


Figure 10-22. Simulated Water Levels in Tank R100

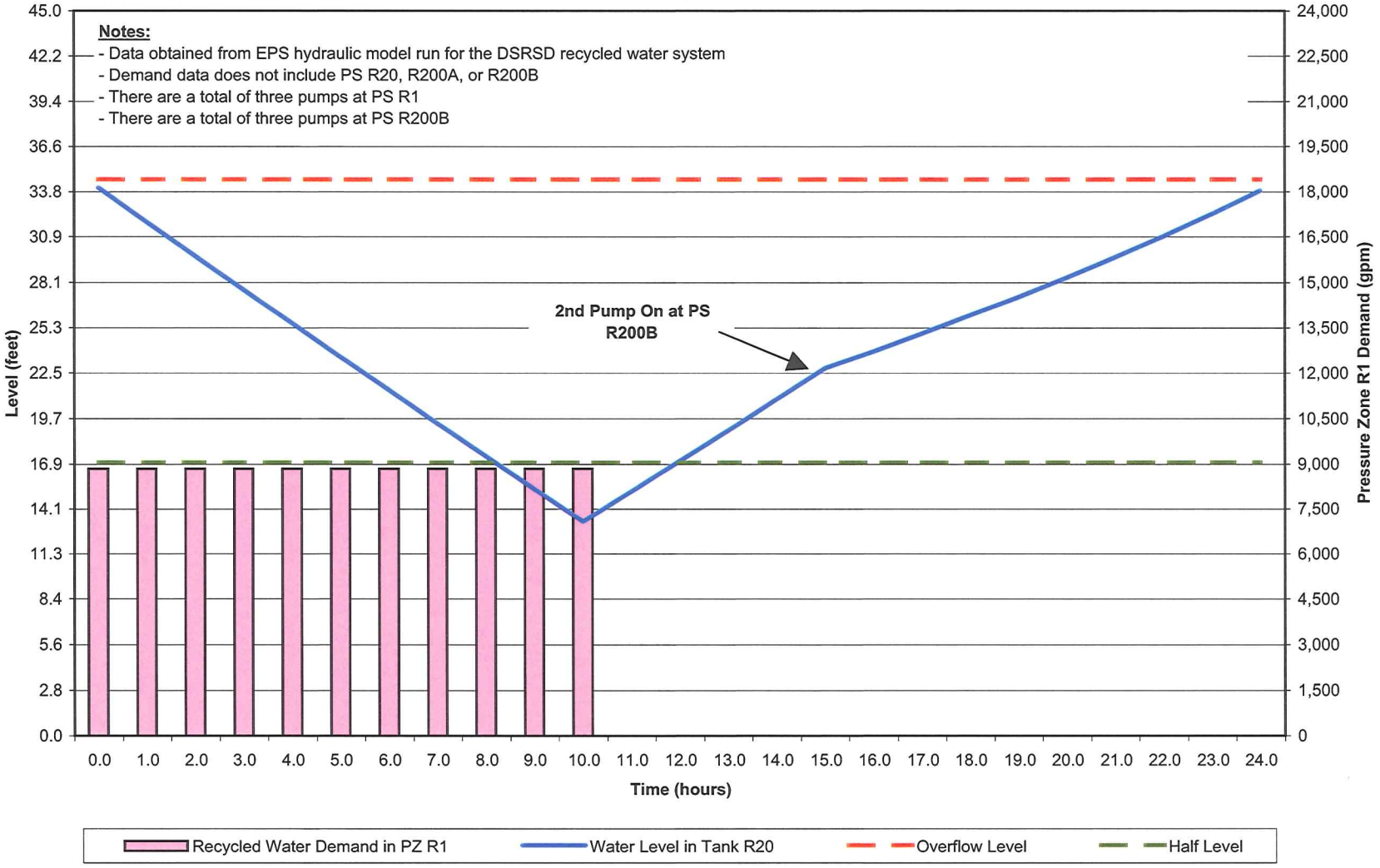


Figure 10-23. Simulated Water Levels in Tank R200

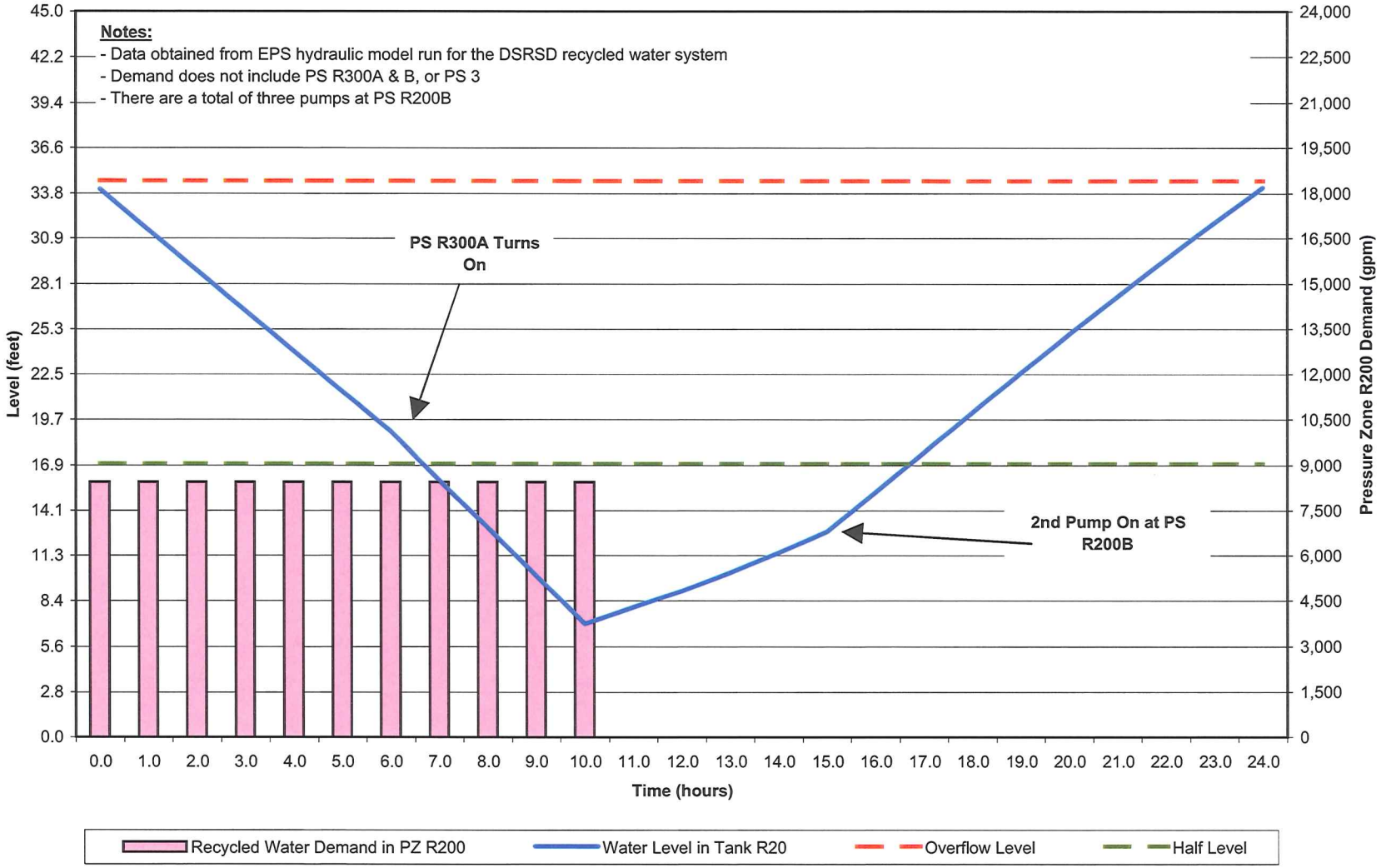
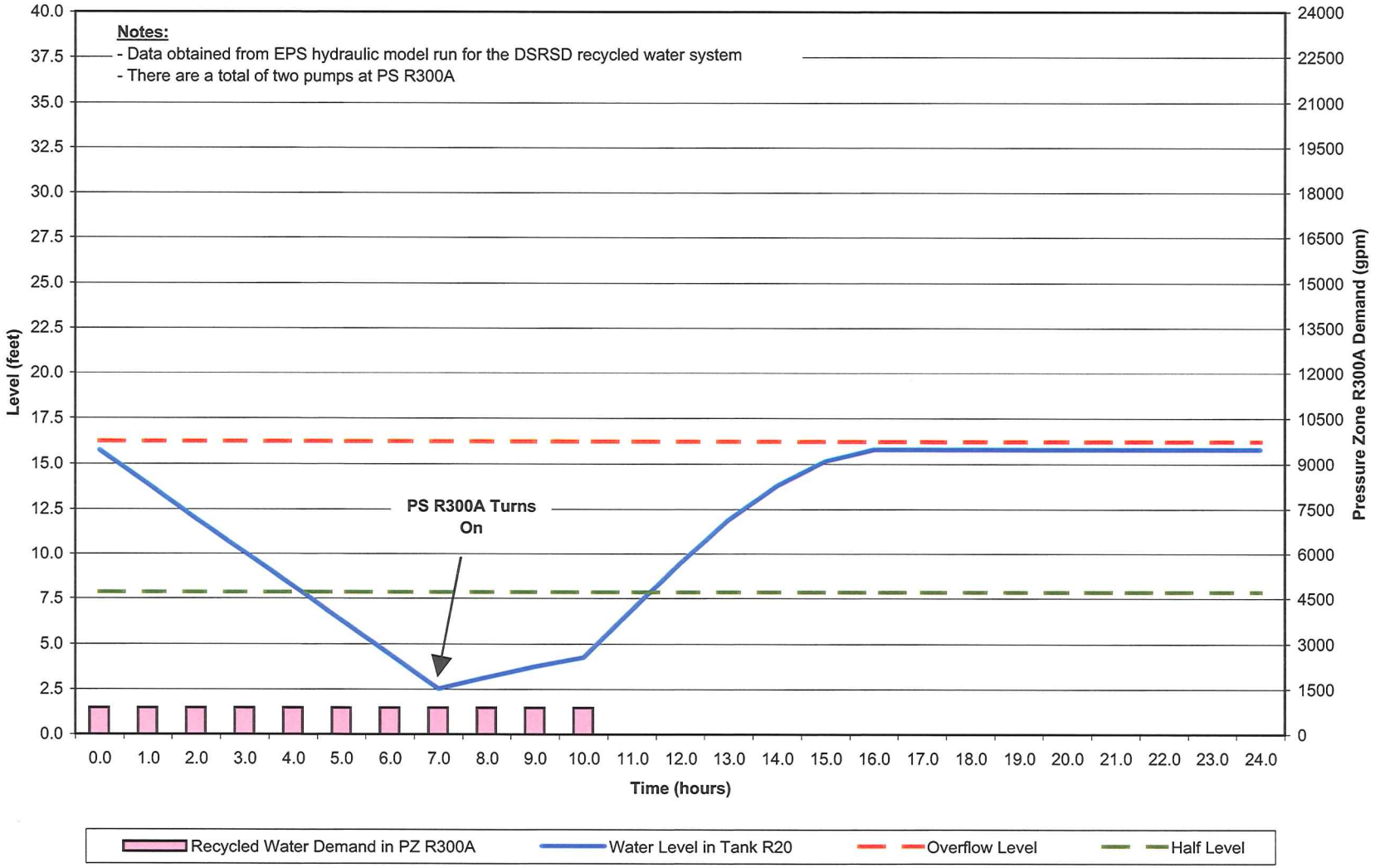


Figure 10-24. Simulated Water Levels in Tank R300



Elevations within Pressure Zone R300B are too high to be served by Pump Station R300A and Tank R300 alone, as the planned service elevations for Pressure Zone R300A were 580 to 670 feet, while service connections within Pressure Zone R300B are well above 670 feet. For this reason, the District decided not to install a pipeline that would connect Pressure Zones R300A and R300B.

RECOMMENDED CAPITAL IMPROVEMENT PROGRAM

The purpose of this section is to present the recommended CIP for the recycled water system. Based on the evaluated scenarios described above, several pipeline improvements and one pump station improvement are recommended. The costs presented in this section represent October 2005 dollars and have a baseline Engineering News Record (ENR) Construction Cost Index (CCI) of 8408.98 (San Francisco), and only include major infrastructure required to be installed by the District. As described in Resolution No. 55-97, approved on October 27, 1997, major infrastructure is defined as all treatment, pumping, storage, and other similar facilities, and all transmission lines with a diameter equal to or greater than 24-inches in diameter. The District has also decided to include the recycled water pipelines necessary to serve parks and schools located east of I-680 and within Central Dublin in the CIP.

The costs presented also include a total markup of 50 percent of the estimated construction cost to account for the following:

- Construction Contingency (20 percent), and
- Cost Allowances
  - Engineering (10 percent),
  - Construction Management (10 percent), and
  - Program Implementation (10 percent).

A complete description of the assumptions used in developing the estimates of probable construction costs is provided in Appendix D. The actual CIP projects were divided into those required by Recycled Water Pressure Zone, as dictated by projected buildout year for each pressure zone (see Figure 10-17).

Table 10-14 presents the detailed cost estimates for the recommended improvements for Pressure Zone R1. No improvements were recommended for the other pressure zones as they are already constructed or do not include major infrastructure. Figure 10-25 illustrates the location of the District's CIP projects. As shown in Table 10-14, the total cost to construct the remainder of the District's recycled water system is approximately $0.82 million.

Table 10-14. Detailed Cost Estimate for Pressure Zone R1[a]

Temporary CIP Designation	District CIP Designation	Improvement Description	Diameter, inches	Total Quantity, lf	Type of Construction [b]	Unit Cost, $/lf	Total Cost[c]
WYA-1	620C620	Along Davona Dr., West of Village Pkwy	4	1,430	Urban	$40	$57,000
WYA-2	620C620	Along Village Pkwy, Btwn Brighton Dr. & Davona Dr.	6	1,240	Urban	$60	$74,000
WYA-3	620C620	Along Brighton Dr., West of Village Pkwy	4	680	Urban	$40	$27,000
WYA-4	620C620	Along Brighton Dr., Btwn Village Pkwy & Iron Horse Trail	8	2,090	Urban	$80	$167,000
WYA-5	620C620	Along Amador Valley Rd., Btwn Iron Horse Trail & Penn Dr.	6	1,170	Urban	$60	$70,000
WYA-6	620C620	Along Amador Valley Rd., West of Penn Dr, then North along Burton St.	4	1,030	Urban	$40	$41,000
WYA-7	620C620	Along Penn Dr., South of Amador Valley Rd.	6	1,450	Urban	$60	$87,000
Subtotal[d]				9,100			$523,000
Construction Contigency (20%)[e]							$105,000
Engineering (10%)[e]							$63,000
Construction Management (10%)[e]							$63,000
Program Implementation (10%)[e]							$63,000
Total Pressure Zone R1 CIP Cost[d]							**$820,000**

[a] Baseline October 2005 ENR San Francisco Construction Cost Index: 8408.98

[b] Urban construction based on unit costs presented in Table D-1 of Appendix D

[c] Costs rounded to the nearest $1,000

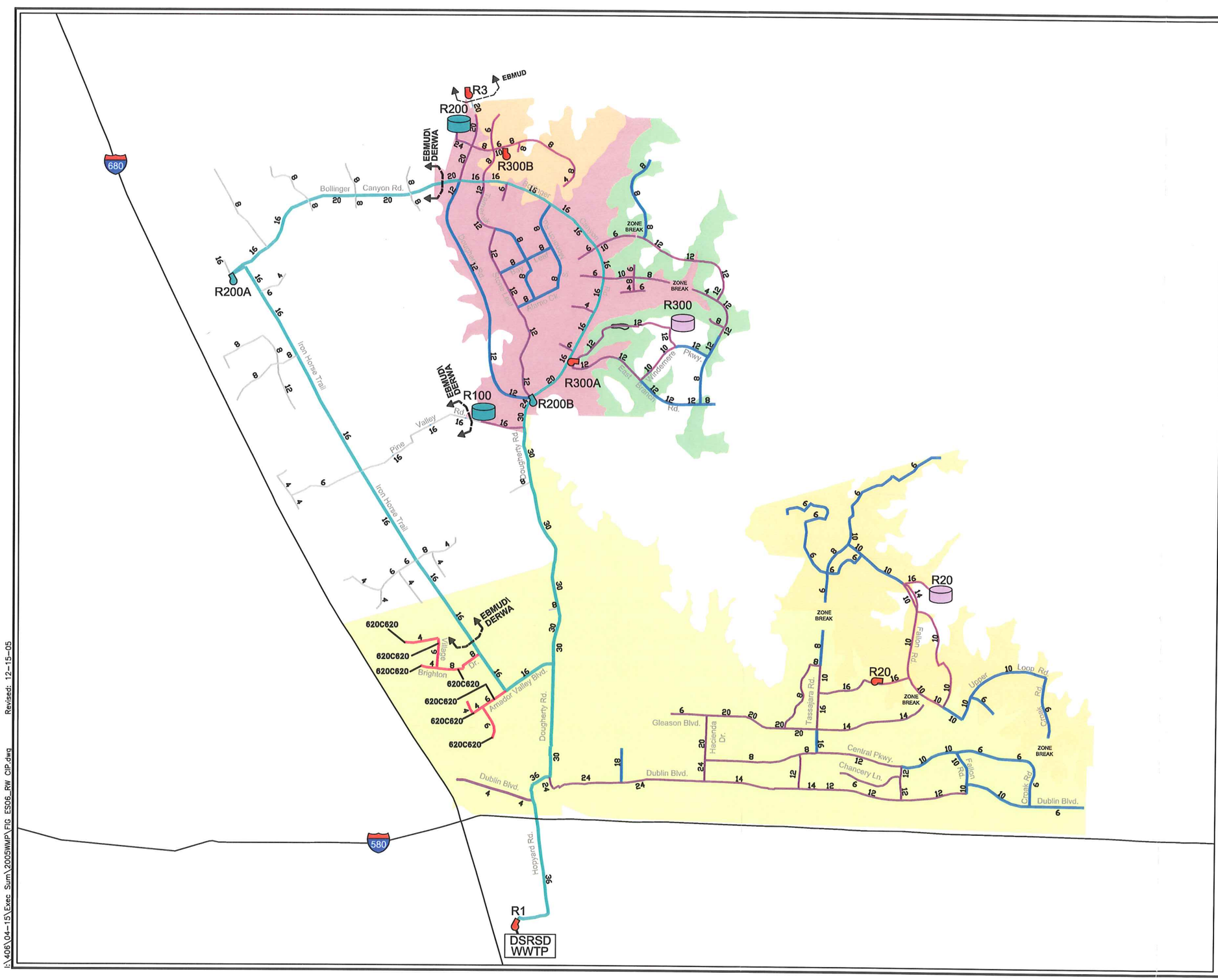
[d] Costs rounded to the nearest $100,000

[e] Costs rounded to the nearest $10,000

FIGURE 10-25

Dublin San Ramon Services District Water Master Plan Update

RECOMMENDED RECYCLED WATER SYSTEM CAPITAL IMPROVEMENT PROGRAM



0 0.375 0.75
SCALE IN MILES

NOTES:

24 Diameter, inches

LEGEND:

- Existing District Pipeline
- Pipeline in the District's CIP
- Pipeline To Be Installed by Developer
- DERWA Pipeline Not in CIP
- EBMUD Pipeline Not in CIP
- District Storage Tank
- DERWA Storage Tank
- 620C620 Infrastructure in District's CIP
- District Pump Station
- DERWA Pump Station
- Pressure Zone R1
- Pressure Zone R20
- Pressure Zone R200
- Pressure Zone R300A
- Pressure Zone R300B

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